

Horny-Handed Heroes



POPULAR MECHANICS

MAGAZINE

WRITTEN FOR THE MAN WHO UNDERSTANDS IT

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18

BUY UNITED STATES
WAR SAVINGS
BONDS AND STAMPS





Remember when ... *you could say: "Fill'er up"... and get it?*

THAT was when Sunday Driving was the Great American Sport, and automobile vacation trips were a "must" for most of us.

Then, tires were valued in dollars—now their worth is measured in *lives*. For the Battle of Rubber is *not yet won*—driving too much, too fast and too carelessly is *still* just like shooting an American soldier in the back. Every ounce of rubber in every tire on every car in America is *still* a war weapon!

Contrary to popular opinion, satisfactory synthetic tires *are not yet available* in sufficient numbers to satisfy both military and civilian needs. No one knows *when* you will be able to replace your present tires.

Those you have *must* last—and *will* last if you observe these simple precautions: Start and stop slowly. Go easy on curves. Don't

bang into curbs, ruts and stones. Keep air pressure up to 32 pounds. *And keep your speedometer down to 35!*

By *lengthening* the life of your tires, you may *save* the life of a fighting man!

* * *

REMEMBER When you found the left rear tire flat that Sunday morning? Who was it who came over and changed it in time for you to get to church? Chances are it was your **INDEPENDENT** tire dealer who has a real interest in pleasing you because he owns his own business. Seiberling believes in the initiative of **INDEPENDENT** business that has always made good jobs and good opportunities plentiful in America. That is why Seiberling Tires always have been and will continue to be sold through **INDEPENDENT** dealers only.

SEIBERLING *Experts in Rubber*



Wartime manufacturers of Bullet-Sealed Tubes and Military Tires for our armed forces • Bullet-Sealing Gasoline Tanks • Rubber Floats, Boats and Pontons • Rubber Parts for Gas Masks, Airplanes and Tanks. Also makers of Tires and Tubes for passenger cars and trucks • Sealed Air Tubes • Rubber Heels, Soles and Mechanical Goods.



"Swifter than a race horse it flew over the icy streets!"

MANY a mustache cup was put down with a clatter. Many a housewife on this wintry Sunday in 1900 dreamed of a new family carriage—*without a horse!*

There on the front page of the newspaper was the thrilling story. Henry Ford had given a reporter a ride in the first Detroit-built automobile—an experimental model. It had been an inspiring experience.

A speed of 25 miles an hour had been attained. The reporter nearly leapt overboard in fright, but had successfully kept his perch over the three-gallon gas tank.

He was now able to record ecstatically that the "big machine rode with dreamlike smoothness"

despite ruts . . . that it "stopped within six feet" and then was off again "like a frightened ghost".

Mr. Ford had proved himself "an expert in cutting circles and other fancy figures". He turned sharp curves "with the grace and ease of a wild bird". Even a milk wagon and a loaded dray were encountered without mishap!

From these early days, the name Ford has never ceased to be news.

The reason lies in the basic Ford principle: *build a sturdy, simple car priced within the reach of the greatest number.*

When production was stopped on the 1942 models, more than 30,000,000 Fords had taken to the

road. Millions of them are still serving America's vital needs.

Much current news of Ford is "restricted," for it has to do with mass production of giant aircraft and other tools of victory.

But there will come a day when Ford news will again feature civilian models. You may be sure they will reflect all the ingenuity and precision engineering traditional with Ford.

Yes, the Ford cars of the future may even challenge the descriptive powers of that forgotten reporter who, at the turn of the century, rolled along the streets of Detroit "swifter than a race horse".

FORD MOTOR COMPANY

This One



F5WA-9SG-7L74



**HELP HIM GET THAT
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You can do it by not using Long Distance between 7 and 10 P.M. Those are the night-time hours when many service men are off duty and it's their best chance to call the folks at home.

BELL TELEPHONE SYSTEM



Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

June, 1944

Vol. 81, No. 6

Next Month

LIFE on a destroyer is not designed for men with delicate stomachs. It takes little more than a ripple to start the "tin can" rolling, and half the time you'll be embracing a stanchion for support while you eat a sandwich, if you can eat. But life on a destroyer is a life of action, says our writer who sampled it on a Pacific cruise and wrote of his trip in "Rough-riders of the Deep," a feature in the July issue. These are the fighting greyhounds that dash right into the enemy battle line and, thinly clad and vulnerable themselves, sink a battleship with their tin fish.

Revolution on Rails

IT HAS already begun, this revolution on rails that will swing into full speed after the war. It has begun with the troop sleepers you see flashing past, cars with triple-deck berths that will offer low-cost travel comfort in the future. It has begun with the lightweight hollow steel axles recently introduced, and the research into gas-turbine engines and aluminum alloys and gyrostabilizers. An article next month brings you a picture of the railroads tomorrow.

Invasion by Air

G IANT gliders swoop silently down behind the steel wall guarding Nazi Europe and disgorge big mobile guns, jeeps and men. From transports overhead thousands of men parachute to strike at enemy strong points. "They Get There First!" Major Vincent P. Wilber of the U. S. Army Air Corps calls his story of the Troop Carrier Command, a feature in July.

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Heroes of the "Hump"

THE CLOUDS over the Himalayas look soft and fleecy, but they are stuffed with rocks. They are also studded with Jap fighters, patrolling the world's most dangerous air route to break up the unbroken caravan of Yankee cargo planes that are ferrying into China the weapons of war. Despite these perils, more planes are leaving the fields of Assam for China daily than come and go at LaGuardia Field! Not all get through. Some have crashed on 18,000-foot peaks, some crews have come home after fabulous adventures in "Shangri-La." Read the story of these "Heroes of the Hump" in July.

The Iron Cavalry

JEB STUART'S raiders fill a brilliant page in the history of the Civil War. The cavalry of this war fights not in the saddle, but in fast scout cars and tanks. They jab behind the enemy lines, scouting, taking prisoners, striking supply lines and depots, seeking out the strong points hidden from aerial reconnaissance. Field glasses and radio transmitters are their primary weapons for scouting expeditions, but they pack big guns too. A July article tells the story of "The Iron Cavalry."

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Need a Motor that can lift 500 times its own weight?

THIS electric motor weighs only a pound. But more power is packed in that one pound of motor than has ever been before.

With Lear gearing it can handle a quarter-ton load.

And it has to be ready to do that in an instant. Because this motor moves control flaps, and heater shutters on warplanes. And air pressures mount high at the speed these ships fly.

On aircraft, even the weight of a coat of paint has to be considered. So this motor had to be light.

There's little room in an airplane. So it had to be small.

Designing it meant starting from scratch. There was no precedent for this kind of engineering.

You may never need a motor like this. It may cost more than you might want to pay.



But if you are looking ahead toward manufacturing some peacetime product, we want you to know that such a motor has been developed along with 250 other Lear products.

And equally important, we want you to know that there is available the kind of engineering thinking that could conceive and produce it.





The guinea pig that traveled 32,500 miles

What happened to it?... Nothing more than the scientists had hoped

J. B. COYLE of Huntington, N. Y., has to do a lot of driving in his company car. In fact, he's one of the top-mileage salesmen the company has. He covers tough miles, too. Many of them over rough gravel roads.

That's why the Lone Star Cement Company chose his car for the test tires . . . the tires with synthetic treads that came from B. F. Goodrich.

This was back in 1940. B. F. Goodrich were trying to find how synthetic rubber would do in actual tires, driven on the road. So they sold thousands of passenger-car tires to private car owners and com-

panies—tires in which half the rubber was synthetic—the first containing *any* synthetic rubber ever sold American car owners.

What happened? Reports rolled in . . . "No trouble . . . still going fine."

The combined mileage of all tires sold climbed to more than 80,000,000! But the test isn't really over yet . . . as you can see by this picture of Mr. Coyle's B. F. Goodrich Silvertown.

After he had rolled up 32,500 miles, two of the tires needed recapping. The others (one of them shown here) still had plenty of tread left, Mr. Coyle reports.

Today's B. F. Goodrich tires for passenger cars are all-synthetic (98%) and are almost as good as pre-war tires. Truck tires aren't yet as good, especially in intercity service with overloads, but are being improved day by day.

If your ration board has given you a certificate for the purchase of new tires, see your B. F. Goodrich dealer or Silvertown store today! *The B. F. Goodrich Company, Akron, Ohio.*



In war or peace

B.F. Goodrich

FIRST IN RUBBER

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"Ah told you them Jeeps kin do tricks we'uns ain't learned yit!"

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"How Can I Make Sure of My Postwar Success?"

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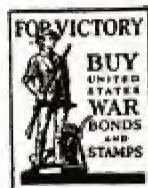
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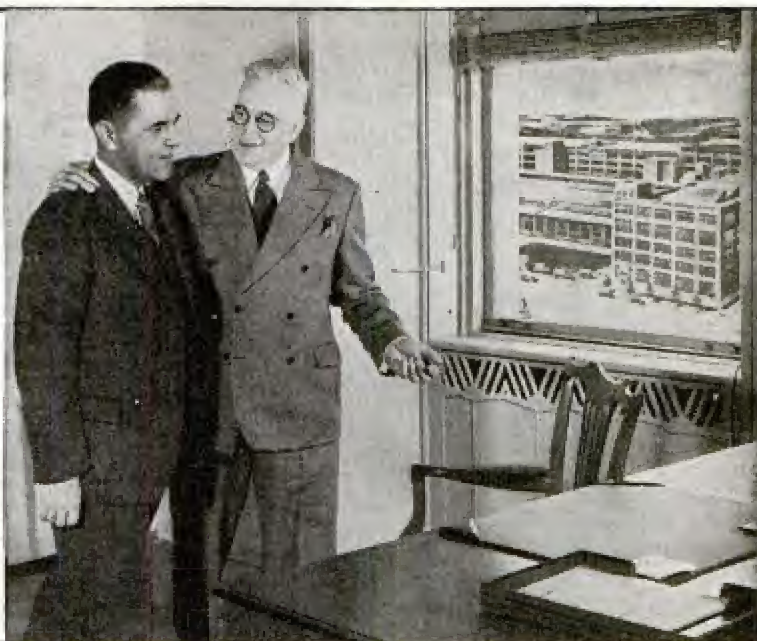
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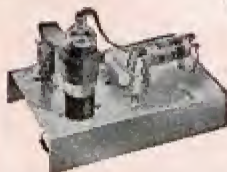
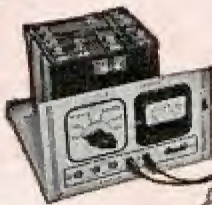
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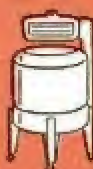
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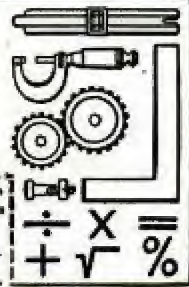
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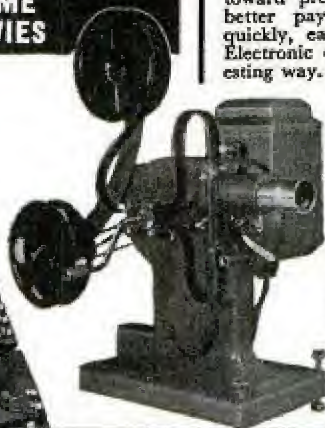
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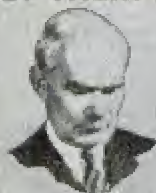
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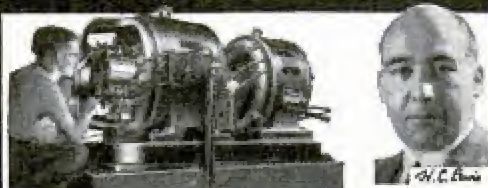
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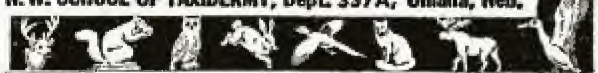
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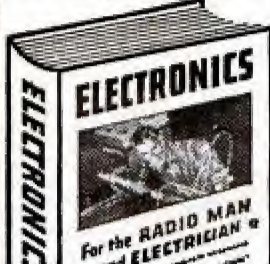
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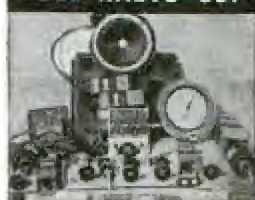
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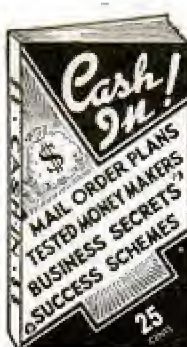
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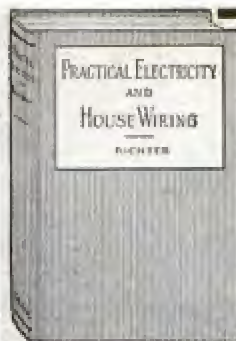
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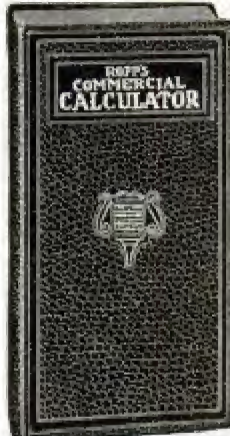
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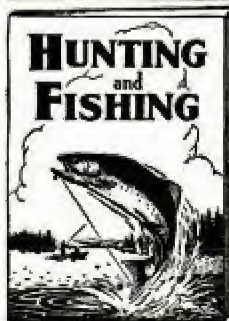
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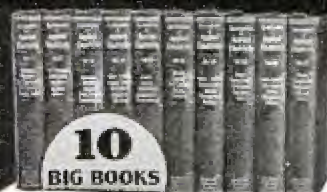


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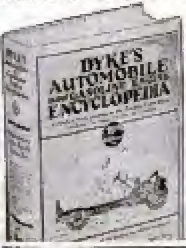
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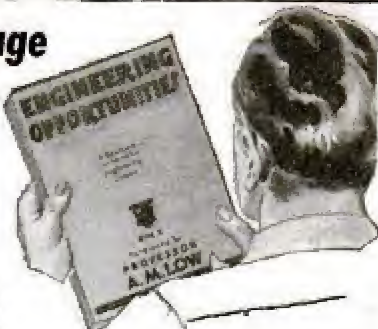


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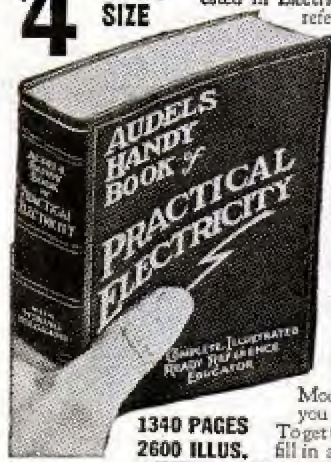
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Chewing gum, too, is really useful and helpful in these tense times to people who are working on the production front making material for our war effort. But, our Armed Forces have been constantly increasing their demands for Wrigley's Spearmint, Doublemint and Juicy Fruit. It is only natural that we and you both feel that the needs of our fighting men and women come first.

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Y-116

Wm. Grant

0141

Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 81

JUNE, 1944

No. 6

The VOICE of AMERICA SPEAKS

Above, banks of recorders "monitor" foreign and domestic radio programs. Below, OWI announcer speaks over United Nations radio

HIGH UP in the sky over Europe a Yankee pilot on reconnaissance tuned in on an American radio program. The thrill that came over the air that day was nearly as good as a visit home.

An announcer in New York was talking. Talking straight to him. It was a "news from home" program. The announcer was saying that he was the father of a son, born 5,000 miles away in Gatesville, Tex. Even the flak looked beautiful at that moment.

The Air Force officer's wife had asked a government office to try to get the message across to him by radio. There could be no assurance that he would be listening. But he heard, and if he per-



JULY ISSUE OUT JUNE 10

The July issue this year will appear on the newsstands and will be mailed to subscribers about June 10, instead of June 1, our usual publication date

formed some unscheduled acrobatics all by himself in the wild blue yonder, there were only the enemy watchers below to wonder about the crazy Yankee flyers.

Radio is a weapon of many edges. It is News from Home, and the best of



In the "switchyard" of a short-wave station a program is beamed to Europe

At right, a military-type hut overseas where the Psychological Warfare Branch picks up and rebroadcasts OWI programs

This sign was posted at General Electric short-wave station in San Francisco



American radio entertainment, boosting the morale of fighting men overseas. It is the Voice of America bombarding enemy and occupied and neutral lands with fighting propaganda. It is the multitude of voices speaking from flagship to destroyer, from foxhole to command post, from Pentagon to Eisenhower, from Flying Fortress to Mustang, from artillery spotter to gunner and tank to tank. It is the radio reporter in Naples and Bougainville talking to you at the breakfast table.

The Nazis had a long start in the radio war when war came to America. They had more than 100 transmitters bombarding the world. We had 16 shortwave outlets under private auspices.

It took us a little time to get going. But today the overseas radio division of the Office of War Information directs a 24-hour flow of entertainment and news and propaganda to every corner of the earth—propaganda strictly adhering to factual news

reporting and flavored with American ideals. More than 2,600 programs a week are beamed to Europe, Latin America and Asia. In addition to the cooperating broadcasting stations in this country there are over a score of outposts in such strategic areas as Iraq, Palestine, Sweden, Lebanon, Iran and Egypt. Eighteen transmitters along our Atlantic coast are on the air 24 hours a day, and at Algiers and other outposts the programs from America are recorded and rebroadcast. The Voice of America speaks in 26 languages.

Naturally the enemy tries to jam our transmission. To get through to continental listeners, average broadcasting speed is kept down to 100

words a minute, and when jamming or atmospheric conditions are especially unfavorable the speakers slow down to 80 words a minute. And despite the penalty of prison or death for listening to an Allied broadcast, there is evidence that we are heard. A survey in the Catania area of Sicily indicated one in every 10 families heard Allied programs before the invasion; of 171 listeners questioned, 53 heard American broadcasts. And there is the story of the propaganda beamed to French farmers.

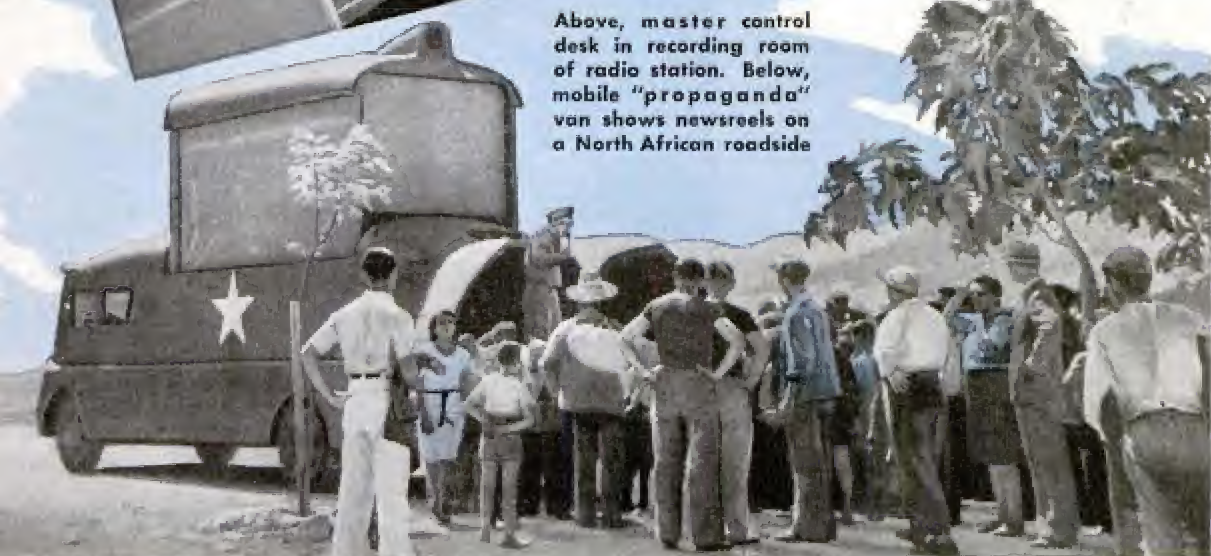
The Voice of America launched a major campaign to keep French crops from feeding Germany. The farmers of France were told of Hermann Goering's promise to the Nazis that "Whatever happens, we Germans will eat first." The farmers were warned not to declare their full harvest, but to hide all they could. The underground was listening. Nazi-controlled ra-



Program schedule at Office of War Information. Many "chain" programs are rebroadcast to troops



Above, master control desk in recording room of radio station. Below, mobile "propaganda" van shows newsreels on a North African roadside





Foreign broadcasts are recorded at Columbia Broadcasting System "listening post," translated and summarized in news of day

... part of a large-scale sabotage plan." Vichy decreed death for terrorists who destroyed threshing machines.

The concerted radio program was launched just a week before we invaded Africa. About that moment radio was

playing a vital role in the actual landing. The Amphibian Command had needed a five-kilowatt transmitter in a hurry. The Western Electric Company had just delivered one to station WHOM in Jersey City, and it was not yet installed. The equipment was rushed to Norfolk, Va. Six weeks later a strange voice cut in on the frequency of the Rabat, Morocco, radio station and African listeners heard in French: "Allo Maroc! Allo Maroc! This is the transmitter of the American Armed Forces." Then the recorded voice of President Roosevelt told of the coming of the Yankees and admonished North Africa to cooperate with the liberators. The voice came from that transmitter on an American battleship lying over the horizon on the Atlantic.

It was radio that brought the Italian fleet over to the Allies when Italy surrendered. The victory is credited to Robert Morris Pierce of Cleveland, an OWI radio engineer. The problem was to get the Italians to listen. Their Navy was forbidden to listen to any other than an Italian station. Pierce, in charge of the United Nations radio at Algiers, solved the problem by shifting the transmitter from its 1100-kilocycle frequency to 500 kilocycles, the international distress frequency to which all ships listen constantly. Every quarter hour for several hours the message was broad-

In picturesque surroundings overseas a Signal Corps unit rebroadcasts short-wave programs of BBC and OWI



cast inviting the Italian fleet to join the Allies. When the Italians did steam into Malta, Admiral Cunningham of the Allied Mediterranean fleet said of the radio staff "they've accomplished in one day with propaganda what I've been trying to do for three years with the Navy."

For the invasion of the continent, Gen. Sir Bernard L. Montgomery has a complete high-powered radio station comprising seven vehicles and a crew of 24 men, capable of broadcasting 45,000 words a day.

The radio newsmen covering the battle-fronts, civilians and military alike, have written—and spoken—an epic in war reporting. The National Broadcasting Company has stepped up more than four-fold the time devoted to news reports since 1938. Over 15 percent of the total time is now allotted to news and special events. The Columbia Broadcasting System similarly covers the world, with about 35 men on foreign news posts. An important phase of CBS work is the monitoring of foreign programs, which are immediately translated by a special staff and made available to newspapers as well as CBS listeners.

Every Thursday the NBC news desk at New York radios its reporters overseas their assignment for the next week. A radiogram to the Moscow man might read: "WANT 1208 1210 TUESDAY THURSDAY SATURDAY ALSO 2319 2321 MONDAY ETTHURSDAY RETURNING NEWYORKWARD CONFIRM." Which gives the Moscow reporter his broadcast time in terms of Greenwich Mean Time. He has no direct contact with New York before or during his talk. NBC orders Radio Corporation of America to pick up the Moscow shortwave signal at the appointed second. RCA's station on Long Island picks it up, feeds it by telephone to the control desk of NBC in Radio City, and 10 seconds before the rendezvous the announcer introduces "Henry Cassidy in Moscow." And Cassidy, who does not hear this, comes in blind on the split second. Some foreign points can be contacted a few minutes in advance on a two-way conversation channel and the cue perfected.

Last Feb. 1 the first all-American owned and operated commercial radio station in Europe began transmitting news direct from Italy to the United States. RCA had installed the \$250,000 station.

A former CBS man, Sergt. Roy A. Maypole, now a Marine combat correspondent, had a notable radio beat in the thick of the Yankee landing on Bougainville island. As the Leathernecks secured the beach-head, he went ashore with microphone and sound-on-wire recorder into which he related the progress of the battle with a back-

Continued to page 164

Cat Helps Engineers at Big Dam String Cable Through Pipe



How to string a cable through a 500-foot corkscrew drain pipe, was a problem which recently confronted engineers at Grand Coulee Dam. The problem was solved by tying a string to the tail of a cat and assisting her through the pipe with a strong breeze of compressed air. After the string was pulled through the 24-inch pipe, it was tied to a rope and the rope to a cable.

Window-Shade Sea Trains Men To Handle Lifeboats

With window-shade cloth for an "ocean," a miniature lifeboat is "cast adrift" to train apprentice seamen in boat handling at the U. S. Maritime Service Training Station at Sheepshead, N. Y. The cloth, which moves on a wooden roller, is made to undulate so that the boat behaves much like a real boat on a heavy sea. A tiny weighted sea anchor is used to demonstrate how the castaway boat must be kept headed into the waves.



Jeep Pulls Train of Airplane Refueling Tanks

Plywood tanks for refueling aircraft at advanced U. S. Air Force bases are being mounted on two- and three-wheel trailers, of which from three to five can be hauled about the air field in "trains" by a jeep. Designed for transport by air, the trailers and tanks are very light and can readily be moved about by hand, even when loaded. The tanks, made of a



Light enough to be lifted by hand and transported by plane, plywood tanks are used to fly gasoline to advanced air bases. At left, jeep hauls tank and ambulance "train"

special plastic plywood bent to shape and glued around three bulkheads, are removable from the wooden trailers, and can be flown in cargo planes to rear line bases for refilling. To make them liquid-tight, the

tanks are given an interior treatment with a petroleum-resistant compound, then covered outside with doped linen fabric for weather resistance and finally tested for leaks by air pressure.

"Safety Colors" Urged for Factories to Reduce Accidents

To reduce accidents among war workers, a scheme of bright "safety colors" for industrial machines was proposed to the Greater New York Safety Council recently by Matt Denning of the DuPont Company. Among the colors suggested and displayed were "Alert Orange," for such danger spots as electrical switch boxes, machinery guards, pulleys and gears; "Noisy Red," for fire protection equipment; "Pre-

caution Blue," for things which should not be used, moved or started; "High Visibility Yellow," for trucks, hoists, steps, edges and railings; "Safety Green," for first aid rooms, and locations of medical equipment; and "Traffic White," Gray or Black, for setting off traffic lanes, aisles, storage areas and corners. For the benefit of the 4 percent who are color blind, symbols in connection with the colors were urged.

Mr. Robert Clark
540 Parkway Bldg.
Pasadena, Calif.

0712

"Water Buffaloes" Can Fight on Land or Sea



The tank that can swim is known officially to the Army, Navy and Marines as the LVT (Landing Vehicle Tracked). But the men who run these new armored amphibians in the South Pacific call them "water buffaloes." These deadly tanks, which were a surprise to the Japs, are at home on land or in the water. They are equipped with a revolving turret and a 37-mm. cannon that can fire from any position, and three machine guns, one of .50 caliber and two of .30-caliber. These "water buffaloes" helped crush Jap resistance in the Marshall Islands and the Gilberts

Above, taking part in a night attack, an amphibian pours fire into an enemy position to clear the way for cargo carrier that will bring troops and supplies ashore. The tanks are carried on transport ships and can be put overboard by the dozen to swim ashore and knock out enemy block houses or strafe troops. Underwater and land barriers do not stop the hard-hitting "water buffaloes." Right, versatile tank crawls onto the land during invasion maneuvers



Mr. Hamilton, Jr.
3872 Franklin Ave.
San Francisco 27, Calif.

0106

The ROAD BACK for DISABLED



Above, demonstrating the spring-type artificial hands which enable soldier who lost his arms to work

Sailor (left) weaves a rug on bed loom while convalescing from the wounds he suffered in action in the South Pacific. Occupational therapy hurries recovery U. S. Navy photo

AMERICA'S wounded heroes are receiving the best care that their country can provide.

A heavy toll of injured and incapacitated men is one of the penalties of warfare. Today, fortunately, science can do far more toward restoring injured men to normal living than was possible in earlier wars.

Behind the scenes of combat the Army and Navy have large and efficient organizations that return wounded men to the United States by plane or ship, move them through coastal hospitals where each patient's needs are studied, then transports him to a hospital that specializes in his type of disability. The objective of the medical organizations is to return each wounded man to duty, or to civilian life, restored as well as possible to the physical condition that he enjoyed before he entered the service.

Blind soldiers are treated at such centers as Valley Forge General Hospital, Phoenixville, Pa., or at Letterman General Hospital, San Francisco. Men who have been deafened go to one of several special centers for the deaf.

Other great hospitals, some of them recently

Braille watch has raised dots so blind veterans can tell the time



VETERANS



Above, pulling this wheel around, against tension, restores strength to arm or shoulder. Left, nurse attaches pulleys to patient for leg muscle exercises

built in the middle west, specialize in other disabilities. Each such center provides all the medical and surgical care needed to restore each man to complete health aside from caring for his main disability. Specialized hospitalization like this enables each patient to receive the attention of specialists who are leaders in their fields, plus the use of specialized equipment not available at most hospitals.

At a center for deafened men, for instance, a patient's hearing is carefully tested with audiometers and other instruments in a soundproof room. His type of hearing deficiency, his ability to hear recorded speech played from records, the pitches that are not heard, whether one or both ears are affected, are accurately determined.

This leads to selection of the best type of hearing aid for his condition, then he is trained in its use. He studies lip reading from an instructor to augment the assistance that his hearing aid provides. He takes lessons in speech correction, too, so that he will continue to talk normally instead of adopting the flat speech of peo-



"Finger ladder" helps injured hands become strong and dexterous

Lower right, soldier exercises on rowing machine in hospital

Below, building models keeps minds busy

ple who can't hear themselves talk.

Men who must lie in bed for weeks will be happier and will recover more rapidly if they have ways of occupying their time. Injured airmen study aircraft models that are suspended above their beds, practicing recognition of friendly and enemy types. Some use flashlights for talking by Morse code from bed to bed or across the room, passing the hours and increasing their proficiency at radio at the same time.

Many sailors and soldiers take up printing, carpentry, book binding and art and design. Others take up wood carving, some make leather articles, a few even take up the art of fly tying, making lures that they may use later for fishing.

One soldier who had been wounded while fighting in the South Pacific occupied his time while convalescing by building an ornate sheath knife. He used part of a broken bayonet, the pin of a hand grenade, the tip of a Jap airplane propeller, and other material that he had collected on the battlefield. The parts that went into the knife, he estimates, killed a total of 18 Japs.

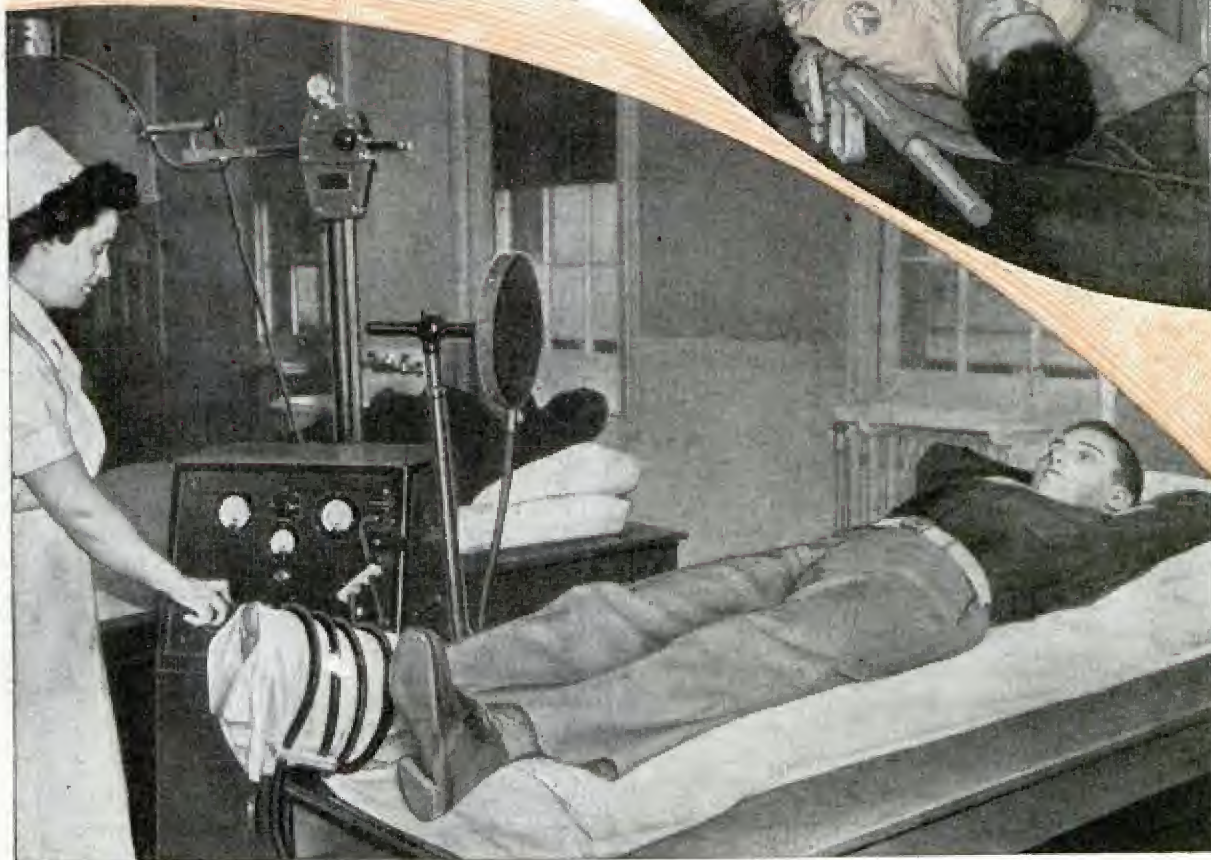
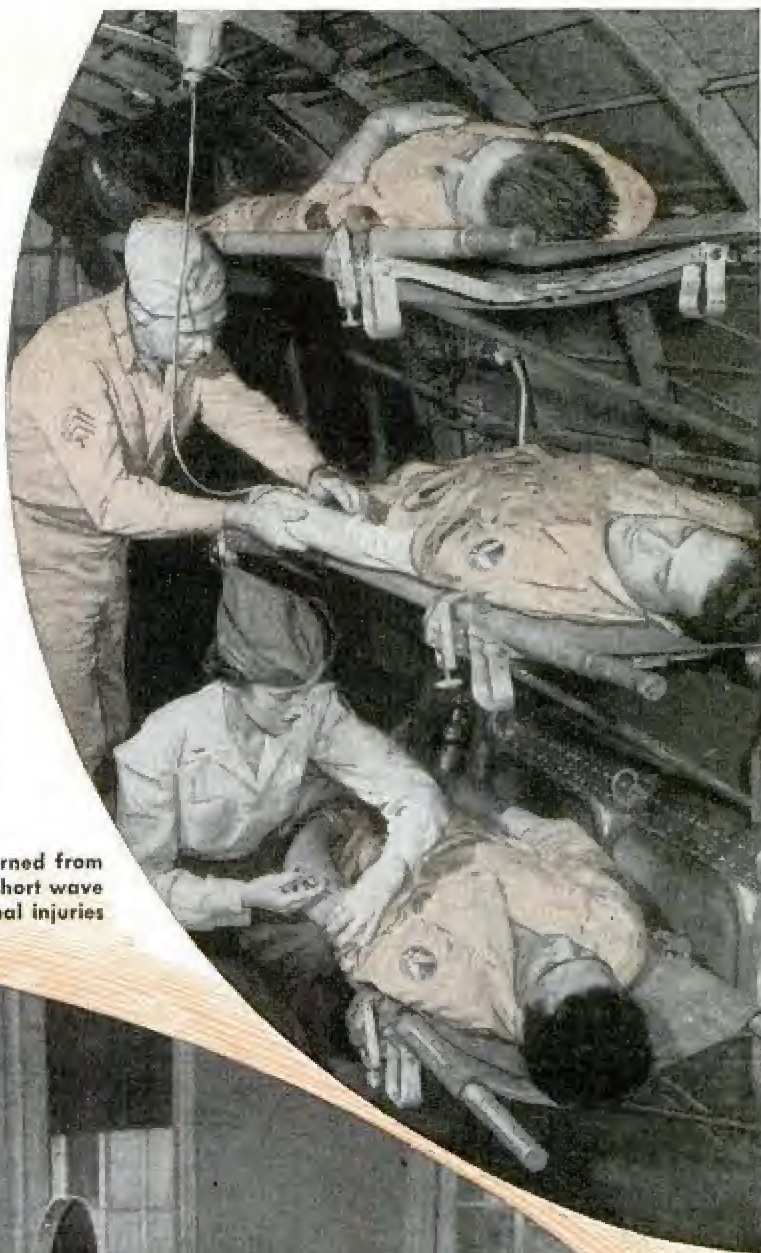
Simple exercises to restore strength and suppleness to injured limbs also speed convalescence. Squeez-



ing soft rubber balls, molding objects from clay, and using sandpaper to shape wooden objects are typical exercises that promote the recovery of injured hands or fingers.

In the gymnasium that is a part of each military hospital, soldiers have the benefit of special apparatus that is designed for their particular needs. A man whose fingers are on the road to recovery exercises them on a "finger ladder," a series of small wooden steps up which he can climb his fingers. A large wooden wheel attached to the wall, with a tension adjustment to make the wheel easy or hard to turn, provides exercise for an injured arm or shoulder. Mirrors behind some of the apparatus allow the soldiers to watch their own progress.

Wounded soldiers (right) being returned from front via ambulance plane. Below, short wave diathermy treatment for deep internal injuries





This typewriter writes in Braille symbols for the blind. Right, hydro-therapy treatment forces hot or cold water past wounded arm

As their strength returns, patients spend a couple of hours or more per day at the hospital farm, weeding and cultivating vegetables. Later they move to a reconditioning center where they play at outdoor sports, drill, and begin a series of hikes that finally restore them to complete health.



Men who have been permanently disabled, in addition to receiving medical care, are schooled in ways of overcoming their disabilities. In one hospital recently a civilian strolled into a ward that was filled with discouraged men. Each soldier had lost a leg in battle and each was gloomy about his future. The civilian visitor walked around, shadow boxed, danced a few steps with a nurse, and then pulled up his trousers. He was wearing an artificial leg. The men cheered up when he told them of new and improved lightweight artificial limbs that are made of resilient laminated plastic. He

demonstrated the floating knee action and the ankle alignment that helped him to walk normally and to engage in such sports as cycling and dancing. He told his listeners of artificial hands that are operated by shoulder muscles and that allow the wearer to do many kinds of work. A one-armed friend of his, he told his audience, has a job in the oil fields doing a man's regular work.

The emotional strain suffered by a blinded soldier is intense until he learns that his instructor, who is also

Many veterans wear these hollow, lightweight artificial limbs so naturally no one notices the difference. They are made of resilient plastic

blind, uses his ears instead of his eyes to help him make his way around. The soldier learns that his instructor tells the time by means of a Braille watch and that he even plays cards with friends, using cards that have raised Braille symbols on them in addition to their regular pictures. Gradually, blind patients learn to care for themselves, how to sign their names, and how to write letters by touch typing. They learn that there are many kinds of work that they can do. Some kinds of farming are easy for sightless men, and chicken raising is a favorite.

Not all the disabilities of war consist of broken limbs and maimed bodies. The shocks of concussion and other terrific noise of war may create a mental exhaustion that is sometimes called battle fatigue or properly psychoneurosis. This is the "shell shock" of the last war. Many men who have suffered battle fatigue are able to return to active duty after treatment.

Rehabilitation doesn't end when an incapacitated soldier is released from the hospital. Men or women who have been in active military service at any time since December 6, 1941, and who have received an honorable discharge may apply to the Veterans' Administration for vocational rehabilitation to overcome any disability incurred or aggravated by their service.

That is, disabled veterans may select occupations at which they wish to earn their living and the Veterans' Administration then arranges for instruction that is intended to fit them for such jobs. Selection of the occupation is based on a person's own experience, abilities, and desires. Instruction is available at universities, junior colleges, and trade schools. If a veteran desires he may be "trained on the job." Maintenance is provided during the training period and for two months after its end at the rate of \$80 per month for a single person, \$90 per month for a married person, plus other benefits for dependents. Loans are also available. Additional information can be obtained at any Veterans' Administration Service office.

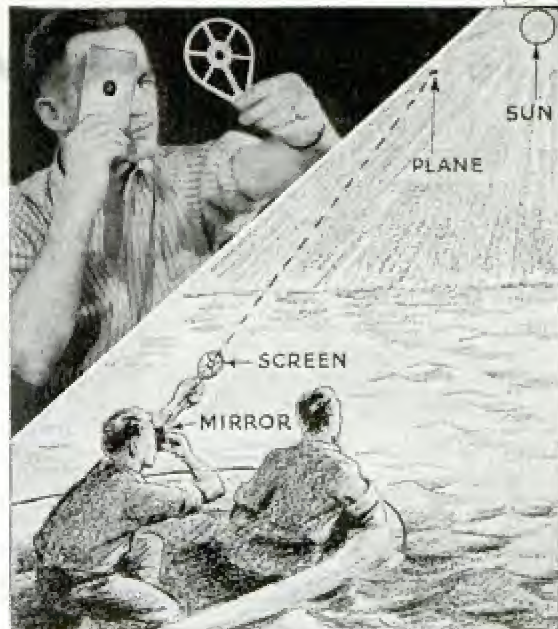
Aluminum Alloy Strong as Steel May Be Used in Armor

Airplanes are expected to be lighter and armor plate stouter as the result of the development of a new aluminum alloy by a metallurgist of the Reynolds Metals Co. The alloy is said to be as tough as structural steel but so light that airplanes constructed with it will be able to carry much greater payloads. The alloy may also replace steel in armor plate, since it is reported to be more effective than steel in deflecting bullets.

JUNE, 1944

*Federal Reserve Bank
Richmond, Va.*

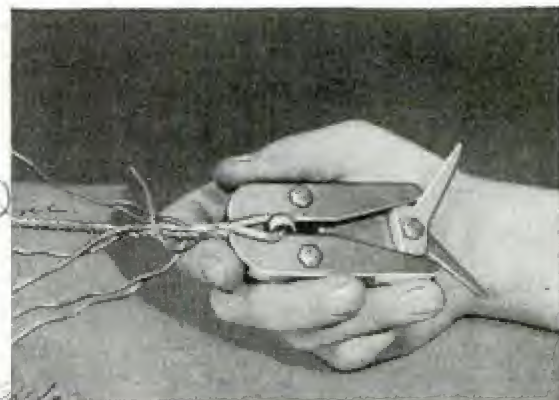
Hole in Center of Signal Mirror Directs Flash on Airplane



Distress signals can be flashed from a raft to an object miles away with a steel mirror and sighting device. Small mirrors, 3 inches by 5 inches, are used for distances up to five miles, and larger mirrors will send a brilliant flash 20 to 30 miles. The mirror, which has a small hole in the center, is held in the right hand and the sighting screen in the left at arm's length. The reflected shadow caused by the hole in the mirror is centered on the hole in the center of the screen which is moved until the objective (usually a plane) is also centered.

Hand Vise for Splicing Cables

Splicing of wire cables which have several strands can be done easier and more quickly by means of a hand-held vise equipped with a cam lever that insures positive locking of the holding jaws in one operation. The cable is thus held snugly to permit the finest splicing.



*C. B. Deal Co.
Aircraft Tool Div.
Lancaster, Pa.*

"PREPARE for DITCHING"



Reproduced from a poster of the Office of Flying Safety, this drawing of a ditched B-25 Mitchell shows two crewmen launching the five-man dinghy, others recovering emergency equipment from the plane

TWO engines shot out by 20-millimeter cannon fire, ragged holes torn in its fuselage, wings and tail gunner's post, the Flying Fortress limped home from battle in Nazi skies. There were still seven miles of Mediterranean waters ahead. Cape Bizerte was in sight, but the last drops of gasoline were running into the two surviving engines.

The pilot, knowing he could not make shore, issued his warning: "Prepare for ditching."

None of the crew had ever been forced down at sea, but the pilot had put his men through many a ditching drill on the ground. Each man gathered his assigned equipment, took his assigned place. The pilot maneuvered into the wind, dropped

Crash positions in a Flying Fortress—pilot and copilot at controls, others braced for shock in radio room

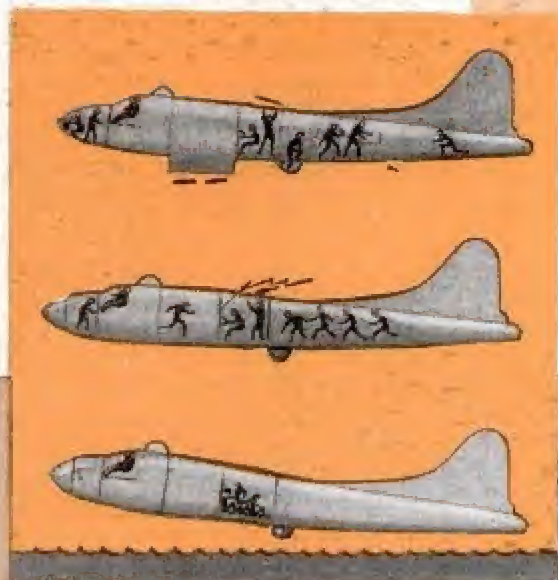


the tail to prevent a nose-over.

"The plane settled into the sea and plunged through a large wave," the B-17 pilot reported. "We seemed to stop instantly. Everything and everyone was slammed forward."

In the three minutes the bomber remained afloat, every man climbed aboard the raft. The pilot

Right, crew of a B-25 ready to ditch. Below, B-17 crew jettisons bombs, guns and loose equipment, closes bomb doors, gathers emergency equipment in radio room, radio is set to send SOS automatically, and men take crash positions

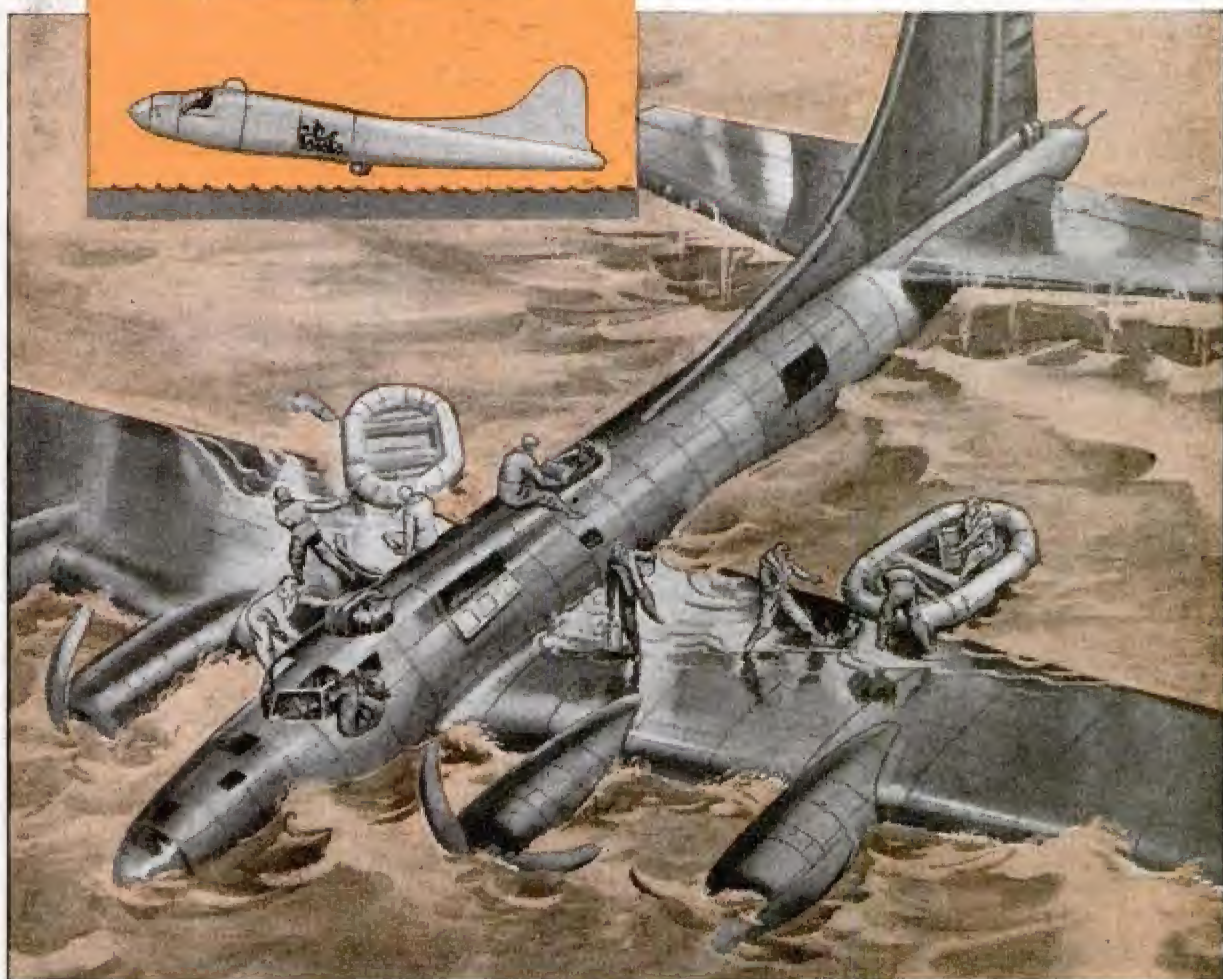


divided the emergency rations to stretch over three days; but luck was with them. African natives had seen the crash, and small boats soon arrived.

Luck is not always so kind, but thanks to experience and to the "ditching" instructions prepared by the Air Force Office

Continued to page 150

Crew of ditched B-17 escapes in good order



Six-Engine German Transport Loads 130 Troops

063



Germany's largest transport plane, the Me-323, has six radial engines and five pairs of wheels for landing on rough ground. It can carry 130 fully armed troops or 12,000 pounds of cargo, including a light tank, a field gun, a three-ton truck, or innumerable oil and gasoline drums. It also is used as an ambulance ferry. The plane has enormous bow doors similar to those on giant gliders and naval landing craft.

Flown extensively by the Nazis on the Eastern and Mediterranean fronts, pictures and a description of the huge plane were published recently in a German-controlled French magazine.

092

Huge Flying Boat Lands on Sand Without Popping a Rivet

With visibility zero-minus, the pilot of a fully loaded night-flying Martin PBM-3

Mariner overshot a channel and made an "impossible" but perfect landing on a sandbar. The landing was so smooth the pilot called for soundings when the 24-ton patrol bomber came to a stop. When a service crew arrived in a crash truck to pick up the pieces, they found that not a rivet had popped. The only damage was the loss of a couple of coats of paint on the bottom of the hull and from a wing tip float. The crew attached beaching gear and rolled the "amphib" into the water from where it took off for its base.



Glen L. Markin Co.
Baltimore 3, Md.

Rockets Fired as Targets for Ack-Ack Men



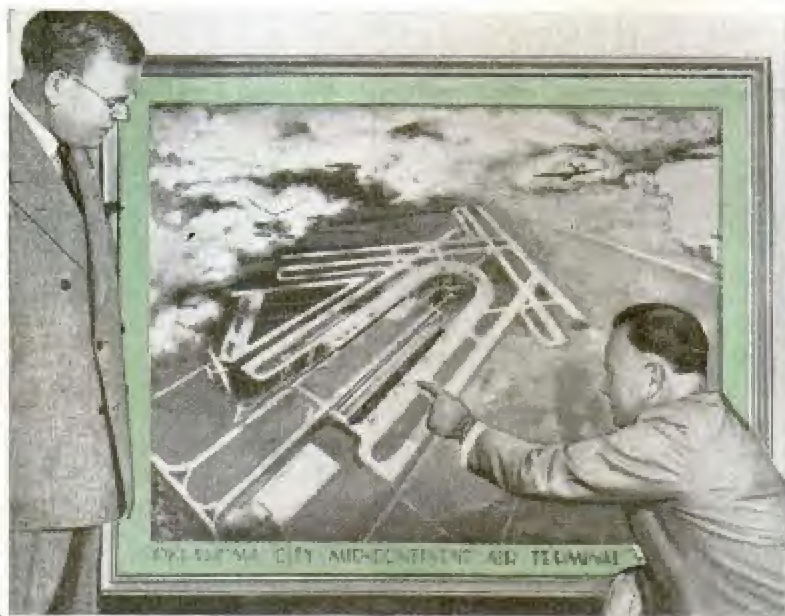
Bands of light at left indicate jet-propelled rockets zooming out of specially designed launching carriages at Camp Davis, N. C., where rockets are fired into the sky to simulate enemy planes diving at great speeds as practice for anti-aircraft artillerymen in training. Below, a cloud of dust rolls up, hiding the launching carriages, as rocket targets race upward, leaving short trails of fire behind.



One man (above) is sufficient to load one of the speedy, fifty-nine-inch rockets onto the unique launching carriage. One fin fits into the narrow groove between the railings that form the nose of the carriage. Three launchers are shown being loaded at the same time. The rockets have an initial velocity of 450 miles per hour, or 675 feet per second. Right, trainees crouching behind 50 caliber machine gun turrets go into action as their crew chief gives signal to fire. The rocket always describes an approximate parabola and has a maximum horizontal range of 2,200 yards. The streaking targets keep ack-ack men on their toes, thus preparing them to cope with the jet-propelled planes of tomorrow, in case the enemy perfects such planes before World War II is finished.



Glenn Co. Martini Co.
Parker Potatoes Regd.
Bathurst M.S.



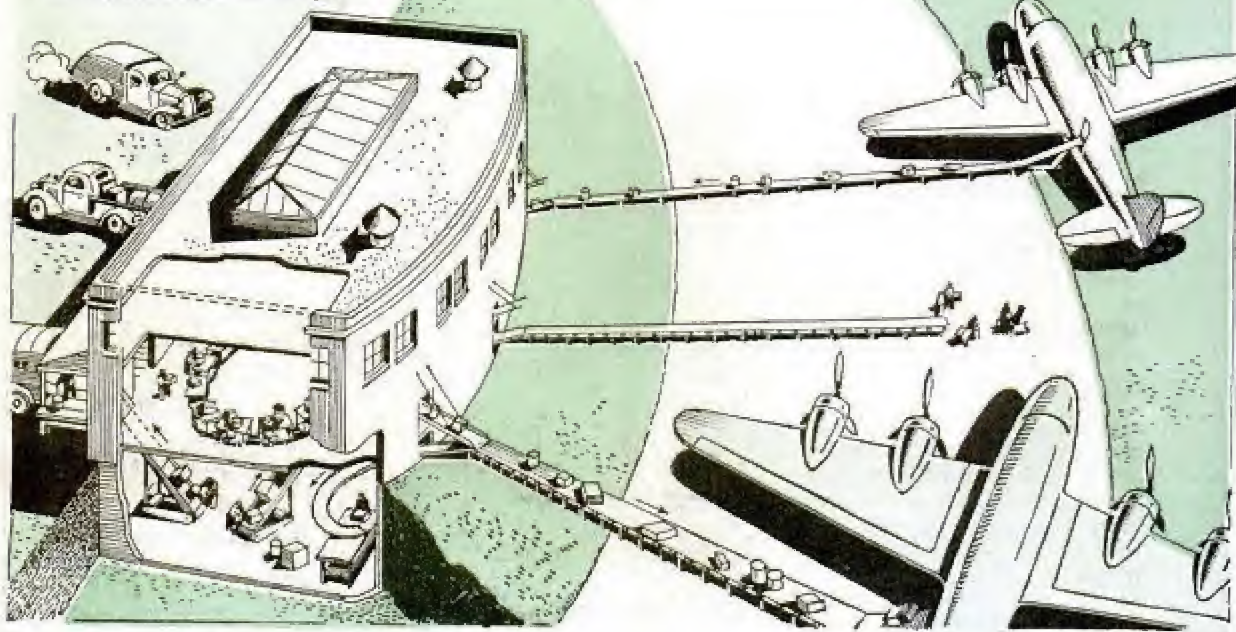
Oklahoma City proposes to build this \$25,000,000 airport covering six square miles, plus a 2,500-acre seaplane base

By Roderick M. Grant

IF THERE is one certainty in an uncertain world, it is that postwar aviation will be a giant bearing only a family resemblance to its prewar self.

The Civil Aeronautics Board is staggering through a paper hurricane of applications for more than 350,000 miles of air routes that would link every small American city with Calcutta and Moscow and Batavia. One trucking company would emerge from its chrysalis as an air cargo carrier serving "all foreign countries," and the

Two-way conveyors with chutes to be raised or lowered for receiving or loading cargo are suggested for air depots
Courtesy Air Transport Magazine.



AVIATION *in* LONG PANTS



Greyhound bus lines would fly the touring public grasshopper-fashion on some 60,000 miles of helicopter routes.

There are a lot of glib predictions on the air—predictions by amateurs and experts. Talk of trans-polar air travel and 125-ton planes and two helicopters in every garage.

"Kids will be able to fly the aerocars, roadable planes and helicopters," says a hotel man. "They'll have folding wings and collapsible propellers; the operator will be able to land on the hotel, fold his wings, drive down a ramp and go anywhere."

The Douglas C-47 army cargo carrier above has been fitted with experimental pontoons 41 feet long, for landing on ice, snow or water. The pontoons have rudders for steering on water. Glimpse of the Martin "Mars," below, gives an idea of immense size of this Navy freight plane

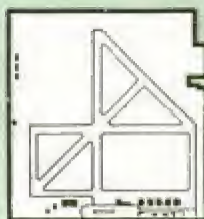




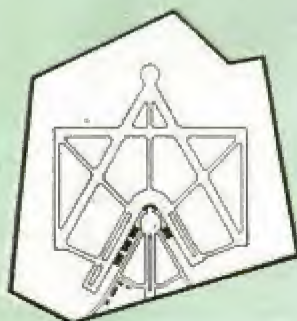
EFFECTIVE LANDING
STRIP LENGTHS
1800'-2500'



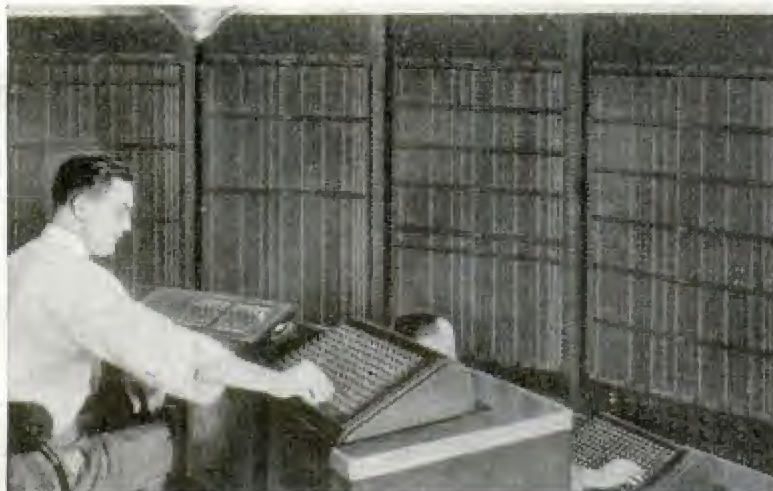
EFFECTIVE RUNWAY
LENGTHS 2500'-3500'



EFFECTIVE RUNWAY
LENGTHS 3500'-4500'



EFFECTIVE RUNWAY
LENGTHS 4500'-5500'



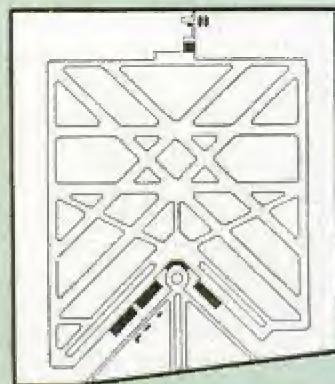
Automatic flight progress board at Washington National airport

An Atlanta advertiser promises: "Our helicopter cabs will meet you, land you high over Peachtree street 'mid comfortable hotels. . ."

And some of the prophecies are not wholly dream stuff. A few weeks ago a helicopter piloted by a Coast Guard commander alighted on the toe of Manhattan island in weather that had grounded all other aircraft, took aboard two cases of blood plasma for survivors of the destroyer that had blown up off shore, and 14 minutes later delivered its cargo at the Sandy Hook Coast Guard Station, an hour and a half distant by boat.

The incident, lost in columns of war news, pointed up the fact that the wingless flying machine was old enough to go to work. Most Americans have dreamed of the fun of flying their own helicopter from the back yard to the beach or office, not bothering to think of its utilitarian roles as rescue craft in forest or mountain region where no winged plane could land; as aerial ferry between airport, city and suburb; as observation post for forest ranger or construction engineer, mineral prospector or relief director in a flood.

At lower left is experimental Piper trainer, perhaps tomorrow's family flivver. Left and below, CAA's five typical airport plans



EFFECTIVE RUNWAY
LENGTHS 5500'-6500'

Rotor craft will find their useful place in the peacetime atmosphere that is weighted by commercial considerations of price and performance, but they will not bloom overnight in the average man's postwar victory garden. Nor will the jet propulsion plane, another war baby. The backlog of buyers for our overbuilt aircraft industry will be the 350,000 or more warplane pilots and the 5,000,000 men and women skilled in aircraft industries and military ground services. The helicopter is too slow, the jet plane too hot for pilots trained in conventional warplanes. For a few years after the first World War the infant aviation market was glutted with leftover fighting planes. Not until they were absorbed did the manufacturers introduce a new breed of private planes.

This time, as before, the industry will again have conversion problems. It is fairly obvious that 400-mile-an-hour fighters with 2,000 horsepower engines will be too costly, too fast, too profligate of fuel for the lieutenant in civilian clothes. But training craft like the Ryan and Beechcraft, and "grasshopper" liaison planes like the Stinson and Taylorcraft, Aeronca and Piper Cub, should be available in the price range

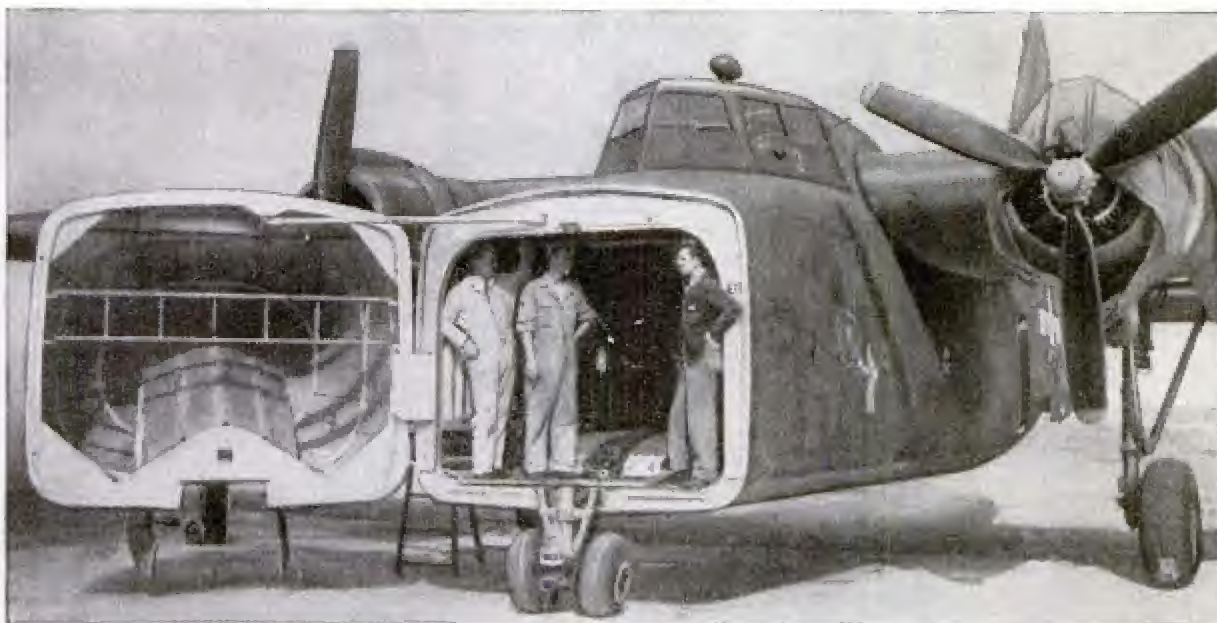


This twin-rotor craft is one of more than 40 helicopters in development

for the boys homecoming from Berlin. For other millions not already pilots, there will be the Ercoupe and Skyfarer, whose production began just in time to be stopped by the war, whose simplified controls and safety through spinproof engineering will appeal to the beginner. General use of the helicopter will come later, when its controls are safe and simple and commercial use has made its advantages manifest.

What will happen to the vast fleet of big bombers is problematical. They are not built to carry freight, and it is unlikely many will be converted. Harold Crary, United Air Lines vice president, believes new planes designed specifically for passenger and cargo carrying can be built soon after the war at a much lower cost in dol-

Its front opening to admit cargo as large as an army jeep, this plane is built of plastic-bonded plywood





Pennsylvania-Central Air Lines proposes a New York to London route via three of these floating seadromes

lars and efficiency than the "staggering" cost of converting bomb carriers into work horses.

"The air lines," Crary says, "would be inheriting a terrific headache from the war if they ever attempted to make passenger-cargo planes out of bombers."

The expectation is that a four-engined plane like the Curtiss Commando or the Douglas DC-4, famous C-54 carryall of the army, will supplement the DC-3 (C-47) on high-speed, limited-stop transcontinental schedules, the DC-3 and similar twin-engine planes continuing to serve interme-

diate stops. United Air Lines anticipates a probable postwar fleet of 40 DC-3's and 67 of the DC-4 type. TWA is likely to adopt the four-engined Constellation, Lockheed's shark-like transport that flies faster than a Jap Zero. Boeing, Martin, Consolidated and Sikorsky flying boats will undoubtedly have competition from these land planes for transoceanic business. Most wartime transoceanic routes are flown with four-engine land planes.

A year or two after the war, some of the new aircraft now on drawing boards or in engineers' brains may begin to appear.

Flying boxcars that can lift 38 tons of cargo are already under construction. A British designer proposes an eight-engine liner to carry 50 passengers over a 3,450-mile range at a cruising speed of 350 miles an hour against a 50-mile wind—higher performance than any transport yet built. Experience with the army's jet propulsion interceptor should speed the development of a tailless, propellerless "flying wing" which Dr. H. L. Dryden of the De-



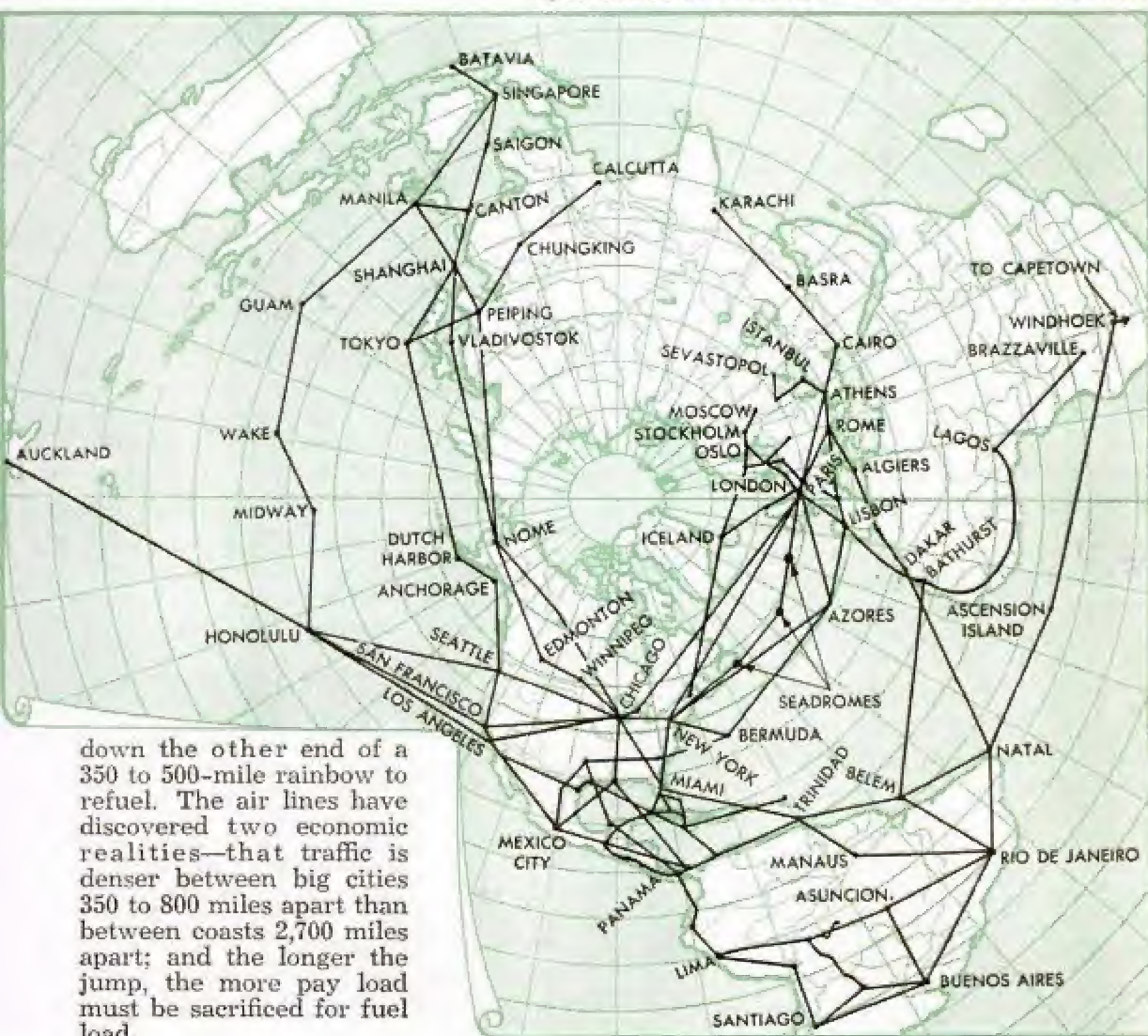
Stowing cargo in an Air Transport Command plane. Its world-girdling experience will be invaluable to postwar air lines

partment of Commerce says is not far from reality. Glenn L. Martin awaits a slack in the bomber production line to build two- and four-engined cargo planes with a twin tail assembly resembling the Lockheed Lightning, tails connected to wings by booms. The aft section of the fuselage opens upward to admit cargo, ramps and winches being provided for rapid handling of freight. The four-motor model would have a gross weight of 86,000 pounds and carry 13½ tons of cargo.

Despite the easy talk of super-colossal giants soaring through the stratosphere, such a spectacular development is probably to remain an uneconomic dream for some years. There is not much point in climbing 10 or 12 miles in heavy, costly, supercharged-cabin planes only to slide immediately



Above, hoisting cargo into a Douglas DC-4. Below, map of foreign routes on which our air lines have asked authority to run



down the other end of a 350 to 500-mile rainbow to refuel. The air lines have discovered two economic realities—that traffic is denser between big cities 350 to 800 miles apart than between coasts 2,700 miles apart; and the longer the jump, the more pay load must be sacrificed for fuel load.



Westinghouse photo

Airport dispatcher's desk has wind and weather indicators, map of runways, and switches controlling all boundary lights and beacons

William Littlewood, engineering vice president of American Airlines, suggests small pickup planes, helicopters or pickup gliders for "cowpasture" service. He proposes four standard transports: (1) a feeder plane seating 25 to 30 to serve small communities; (2) a four-engine plane with pressurized cabin for 40 to 50 passengers traveling 500 to 1,000 miles at up to 250 miles an hour, perhaps 50 percent of its capacity converted for cargo; (3) a 50 to 60 seat two-engine plane operating at 225 miles an hour on 250 to 300 mile jumps on routes of high density, a plane that could be converted into a flying boxcar, and (4) a long-range, four-engine, pressurized transport-sleeper traveling 300 miles an hour over a 3,000-mile range.

United Air Lines engineers favor four types of planes for use perhaps five years after the war: a four-engined, 62½-ton, 100-passenger transport,

The spinproof "Skyfarer" with fixed rudder and simple controls is a candidate for the postwar plane market

with a cruising speed of 250 miles an hour and a range of 3,000 to 3,500 miles, primarily for over-ocean passenger operations but capable of carrying reasonably large amounts of cargo; a four-engined, 35-ton, moderate range passenger type for domestic deluxe sleeper service; a four-engined, 25 to 30-ton "club" carrier for passengers and cargo, and a twin-engined 16-ton plane for passenger service, as a "flying freight car" or a combination.

For a long time the air lines have been chanting the slogan: "All first class mail by air." Now the CAA thinks this is near realization, and the air lines look hopefully upon a proposal that Congress establish a parcel post air mail rate. Air express and freight have grown astronomically since the war, and will expand mightily as feeder lines provide service off the main routes and special cargo carriers and loading facilities become available.

In the last year there has been a mad scramble among the air lines to be ready to

grab all the air within the government's gift at the moment the armistice whistles blow. Some 600 applications are on file with the Civil Aeronautics Board for domestic and foreign routes. Even an aviation college asks to operate over 13,000 miles of feeder lines between Detroit, Minneapolis, Dallas and Amarillo. The several major air lines that have operated overseas routes for the Army Air Transport Command want to cash in on their worldwide experience. No less than 25 companies

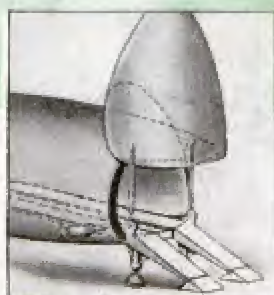




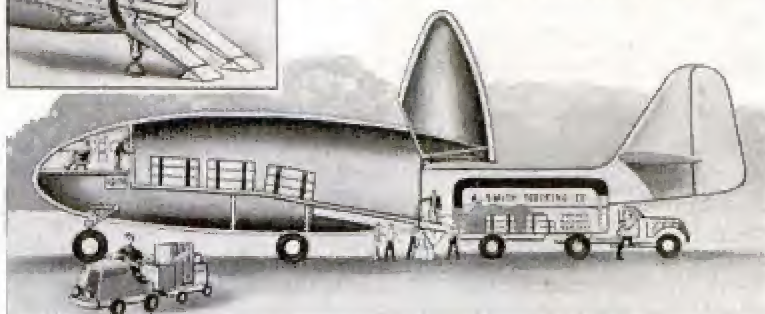
seek air routes to Latin America. Pennsylvania-Central Air Lines is a partner in a helicopter project, and proposes an 8,000-mile Caribbean and Latin American service besides a route to London providing stops at three floating bases stationed 800 miles apart. Chicago & Southern has applied for 41,267 miles of routes, most of them foreign, including a great circle route from the Mississippi Valley to Nome, Vladivostok, Shanghai, Saigon, Singapore and Batavia. Northwest Airlines seeks 26,600 new miles, would fly from New York to Honolulu via Seattle, and via Nome to Tokyo, Shanghai, Calcutta and Manila. American Airlines would add 6,878 domestic and 4,385 foreign miles including flights from Boston and Detroit to London. Western Air Lines looks toward Alaska and South America, with 5,955 miles of new domestic feeder routes.

Continued to page 160

American Airlines unloads cargo on wooden slide—an idea borrowed from child's playground



Designed for future by a Glenn L. Martin engineer, this tail-opening freighter could carry loaded truck or load boxes with winch



21818

"Ferris Wheel" Carries 12 Wings for Painting



Spraying wing panels on monorail conveyor which swings them up and out of the way to speed production

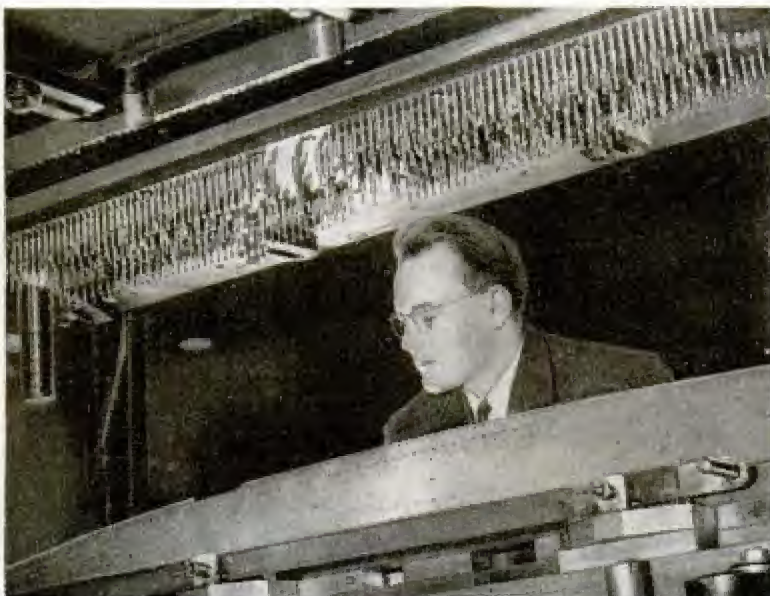
Installed in the "dope" room at the plant of Piper Aircraft Corporation is a unique, labor-saving "ferris wheel," which speeds handling of wings and fuselages. Its capacity is six fuselages and 12 wing panels

Luck Haven, Pa.

which, when dope is applied, swing up and out of the way to make ready for the next application. Over 8,000 feet of monorail conveyor system have been installed to speed production in the vast plant.

21818

388 Punches Mounted on Press Speed Parts for Bomber



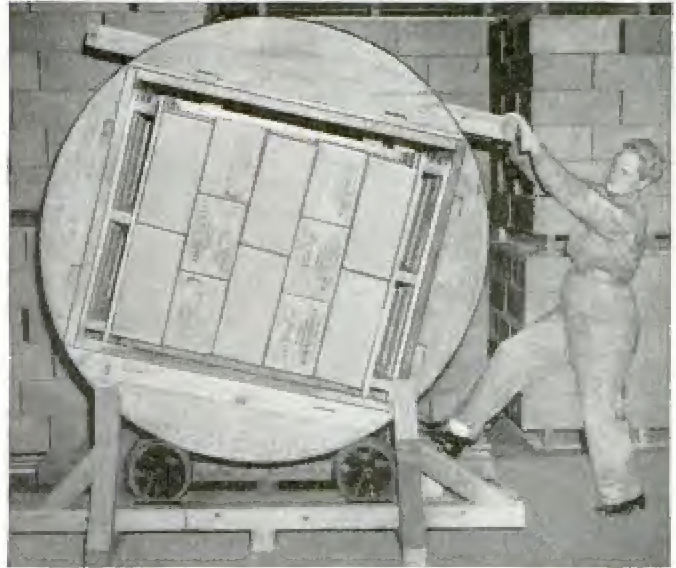
Bomb bay walkway parts for Flying Fortresses are turned out 30 times faster with a punch press designed by workers in the Boeing Aircraft company's Seattle plant. There are 388 punches in the press. They are adjusted to the fine precision required for aircraft production. This improvement is one of many suggested by Boeing workmen in the effort to meet staggering production quotas. Suggested improvements are submitted to careful "laboratory" tests before plant-wide installation.

Wash.

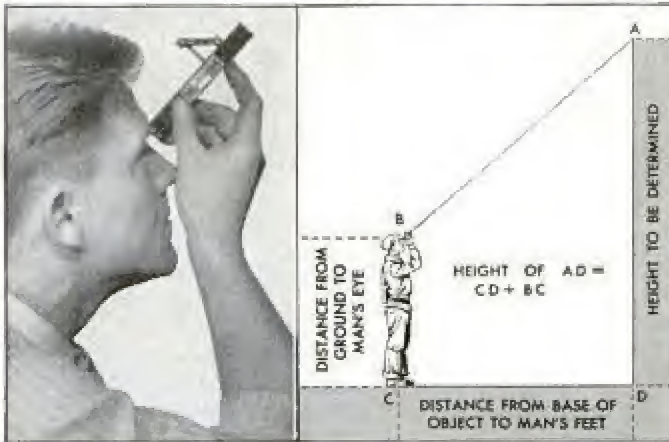
developed by Brig. Gen. J. A. Carter
71895

Topsy-Turvy Milk Can Inverter Saves Labor

Two women are doing in one day what formerly required three days' work of six men, with the help of an ingenious device made of scrap lumber and metal at the San Antonio Army Service Forces Depot. The device helps the women invert 10,000 cases of canned milk a day, a precaution that prevents the settling of the contents of the cans. Formerly each case had to be lifted by hand, and re-stacked upside down. The turning device is circular, with a central hollow square into which 25 cases of milk fit. One woman, using a fork-lift truck, raises the cases and fits them into the hollow; the other turns the wheel-like structure over, inverting 1,200 cans at once.



Sighter Gives Height of Pole by Simple Mathematics



Contractors, appraisers, and repairmen are able to determine the height of a pole, tree, wire, building or other objects quickly and accurately with an instrument so small it can be carried in a pocket. To find how high an object is, the user sights the top of the object through the instrument, moving backward and forward until the bubble rests on the hairline. He then computes the height of the object by adding the distance between himself and the object to the distance from his eyes to the ground.

Ghost Planes in Range and Height Finder Simulate Enemy Air Raid

Operators of range and height finders, among the most complicated of military equipment, are being trained in a speed-up manner by use of a stereoscopic trainer that actually permits the student to train on a moving target. A soldier trainee looking in the eyepieces sees a moving, illuminated target—a high-flying plane, a ship, a tank, or an enemy field position. He operates the controls in the same manner he would on an actual height or range finder. Data collected by the height finder on the "slant range" of a target goes electrically to directors that guide the fire of the guns, in actual combat. On the training instrument, the student's accuracy is



checked by a performance chart that is automatically "drawn" for the instructor's benefit. By using the training device, actual instruments are released for combat.

GROWING



A rough dropping test for cotton bags measures their ability to stand shipping



Cleaning domestic hemp in preparation for use in making cord and rope

WHITE hopes for postwar prosperity are growing in American soil. Miracle crops, they call them, and they range through the agricultural alphabet from abaca to zein. They are the raw materials with which chemurgy, the union of factory, laboratory and farm, is building a new world.

Though only a decade old, already chemurgy promises to remake the face of the earth. It dates from the annual gathering in the mid '30's of experts in chemistry and in agriculture, who sought at once to provide the farmer with more "money crops," and to provide industry with new and cheaper sources of raw materials.

In brief, the chemurgists sought, as they still seek, new uses for established crops; new crops for either new or old uses; and profitable uses for agricultural wastes. Probably few of

a NEW WORLD

This dicing machine cuts up carrots before dehydration→

the chemurgists thought of war. But fortunately for America, when the Japanese in a few short months rolled down the Asiatic coast to the gates of Australia, chemurgy was established, and was ready.

Consider some of the agricultural alphabet that the Japs devoured: abaca fiber from the Philippines, "manila hemp," from which we had made rope, especially the marine rope we now needed so acutely; cassava from the Dutch East Indies, source of the starch for textiles, gums and adhesives on which American industries depended; jute from India, source for the burlap that makes wartime sandbags; kapok, from the islands of the Southwest Pacific, which gives buoyancy to life preservers and rafts; lac—the scale of Oriental insects that forms the basis for shellac; palm oil and tung oil, used in soaps, paints and lubricants; rubber. . . .



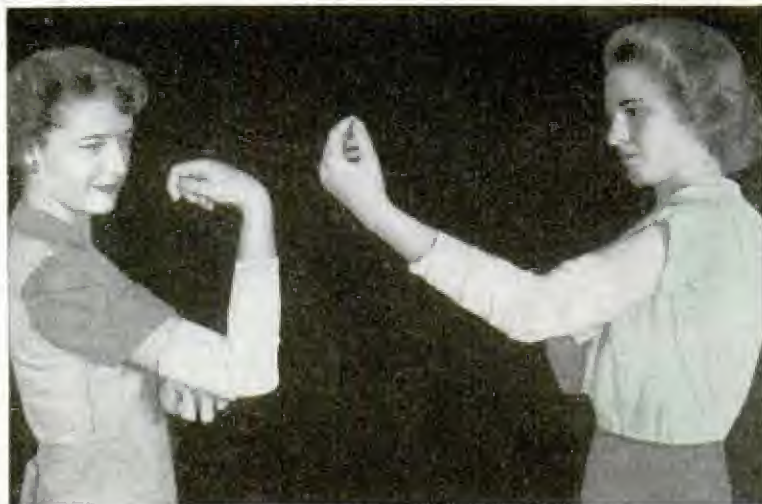
Above, harvesting hemp. At left, chemurgists experimenting with apples have developed apple sirup, useful as a substitute for glycerin



This Jap advance through the Indies proved just how far from self-sufficient America is. Many of these products we could get nowhere else; others supplemented a limited home grown supply. German U-boats sank the ships from South America carrying the tannin from the quebracho tree, the factor that turns hides or skins into leather. They sank the ships from Iberia carrying cork.

America was an industrial giant, but even giants can be starved to death, for their appetites are great. We needed these products, or others like them, or we could not wage war. How we got them is the story of chemurgy.

Modern chemistry and farming are chemurgy's parents. To reproduce, or find a substitute for, a scarce product, chemists break down that product to study its mo-



New two-way stretch cotton bandage (at left) allows freer use of the bound joint than ordinary bandage



experiments Thomas A. Edison had made with growing goldenrod for its rubber content. They got rubber from dandelions.

In the Department of Agriculture's Northern Regional Research Laboratory, they developed "Norepol," a synthetic rubber that uses oils from the soybean, corn, or other vegetables. Other new uses for farm crops are zein, a corn by-product, a substitute for lac; sweet potato starch as a substitute for cassava.

Sometimes the crop we were importing can be grown equally well here. The Japs cut us off from Philippine hemp, but hemp grows equally well in Kentucky, or Minnesota, or Wisconsin—and farmers' incomes are increased by a brand new crop. Last year this crop was grown on 185,000 American acres.

Or a domestic product can substitute almost entirely for a foreign one. Thus, castor beans, whose oil substitutes for tung oil, can be grown on unirrigated lands of the southwest.

Probably the chemurgist's biggest thrill comes in devising a use for agricultural products formerly wasted.

"Nothing that grows is useless," runs chemurgy's creed. "We simply haven't yet found out how to use everything."

Sugar cane, cornstalks and peanut hulls, for instance, are giving us a sub-

Molded plastic articles at left were made of about 20 percent hoofs and feathers. Below, weather-testing sandbags treated for waterproofing

lecular building blocks. Then they examine similar products America is already growing, or can grow, to determine which have building blocks that can be reassembled in the same way.

Most spectacular example is the rapid wartime development of synthetic rubber. In a few weeks the Japs engulfed all the world's supply of natural rubber.

Yet, thanks to chemurgy, we now have not one type of rubber but scores—elastics that can be tailor-made for any quality of stretch, strength, or hardness called for. Chemurgists looked up



stitute for cork. Cork is the product of an oak that grows in Portugal, Spain and North Africa. Even if Hitler's subs had let us carry enough cork across the Atlantic, international politics interfered with trade.

The chemurgists did not need to break down the chemical content of cork to find a substitute. A substitute made of pith and fibers was suggested, but found not suitable, as their air cells are much larger than those in cork, and the membrane much thinner.

But it was found that by cutting the pith into fine particles and incorporating these in a liquid composition that would set and harden to an elastic body, a product would result that closely duplicated the physical structure of cork. This product, made of erstwhile farm wastes, is used for such purposes as the sealing disk in bottle caps.

"Weeds," the chemurgists say, "are just flowers that nobody loves."

Milkweed is one—a chemurgic Cinderella. The fibers of the milkweed floss, like kapok, are hollow, air-filled, very buoyant, and covered with a wax making them virtually impervious to water. The floss is a natural substitute for kapok in manufacturing life preservers. Further, its insulating property is so great that it is used in high-altitude suits for flyers.

Another utilization of waste gave the tobacco industry a substitute for glycerin, now so necessary for the manufacture of explosives. Where apples are canned or dehydrated, the peels and cores are wasted. But chemurgy believes no part of anything that grows should be without its use.

Wasting peels and cores is bad enough, but tons of perfectly good apples were also wasted, because they were off-grade. The chemurgists, already working on apple concentrate from these wastes, turned to experiments with apple sirup, to find substitutes for scarce materials.

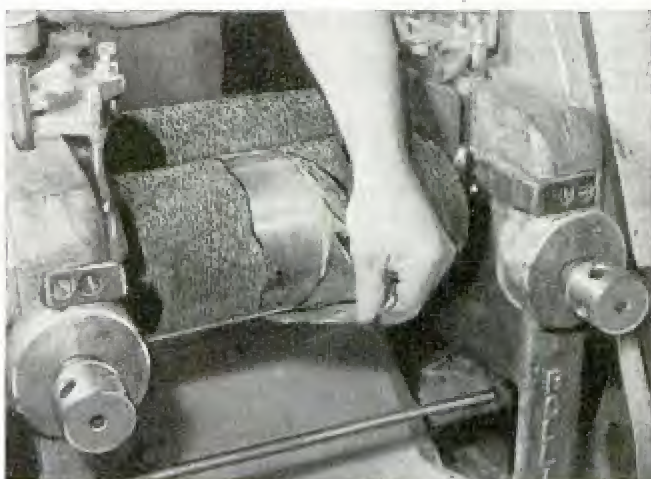
They succeeded. Using these discards they produced in apple sirup a replacement for glycerin. And the ingenuity of these few researchers provides a market for more than 2,500,000 bushels of off-grade apples otherwise wasted each year.

The wasted bark from giant hemlock trees felled in logging camps of the Pacific Northwest also has found

Continued to page 156



Varnish is one of the many new products of soy bean oil. Here a soybean-varnished panel is given an exposure test



Above, milling "Norepol," rubber substitute from soy beans, corn and other vegetables at Peoria laboratory of Department of Agriculture. Below, soybean flakes for plastics

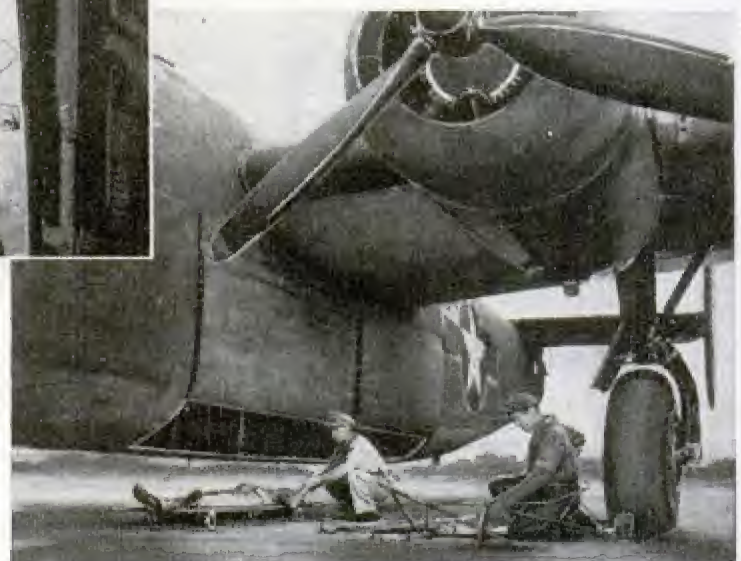


77 860

Stretchers Ride in Bomb Bay of Air Ambulance



America's four-motored bombers, the Liberators and Flying Fortresses, can if required act as flying ambulances to evacuate wounded men from front lines to hospitals in rear zones. The bomb bays are used to accommodate men on stretchers. The Liberator's bomb bay can carry eight sick or wounded men by means of the bomb racks and litters. Thus, carrying a cargo of death on one mission, the big ships may become minions of mercy on the next. As these giant ambulances often fly at great heights, it is necessary for the patients to wear oxygen masks.



Wounded men wear oxygen masks when being transported to base hospitals on high flying bombers. Right, preparing to lift stretcher into the bomb bay of four-motored Liberator bomber

Onion Paste Reduces Infection and Helps Heal Wounds

Experiments by Russian doctors showed that the vapor from onion paste can be used as a weapon against infection and an aid to healing wounds, according to a recent article in the American Review of Soviet Medicine. The article said the essential oils of onions, as well as garlic and certain other strong-scented vegetables, contain bacteria-killing substances called phytoncides. The preparation, which must be made immediately before use, consists simply of grinding the onion or a portion of it after the dry leaves have been removed. The paste is then put in a glass dish with a diameter

equal to that of the wound and is applied so that the paste does not come in contact with the wound but is exposed only to the onion vapor. Vaporization is done for 10 minutes, usually in two five minute intervals with a fresh paste each time. After the first phytoncide treatment doctors said all the wounds without exception became rose colored instead of gray and the patients no longer complained of pain. After the second treatment the pus condition subsided and the odor disappeared. Of the patients treated, seven had amputations of the arm and three of the foot.

Paper Is War Materiel

You can't eat your cake and have it too. But paper is different. Paper is immortal —until you burn it.

Once you have read your newspaper, emptied your candy box or carton from the department store, the paper is of no further value to you. But it is still paper. Turn it in to the scrap collector and it can be remade into paper for a new life of usefulness.

Right now there is a paper shortage. That's not scare stuff; it is plain fact.

Don't waste paper. Bundle it up and call your scrap dealer, your favorite charity or the local salvage committee.

Dr. J. W. Thompson & Dr. A. L. Zaitone
of Omaha State University & the All-Union
Institute of Experimental Medicine, Moscow, U.S.S.R.

SHEPHERDS *of the* CONVOYS



Mr. Cohen

OUT IN THE stormy Atlantic, the days when a U-boat skipper could surface at will to fling a hailstorm of shells at an Allied merchantman are becoming part of a bitter memory. For air power, springing from the decks of that doughty hybrid, the escort carrier, has arrived to dispute possession of ocean lanes.

"Baby flattops," our Navy calls them. "Woolworth carriers" they are known to the British. But their value to eventual Allied victory takes them so far out of the dime-store class that they are, tactically, worth their tonnage in gold. They are the eyes of the United Nations convoys.

Wolf-pack tactics by Nazi U-boats form a many-unit ambush. One submarine, working alone, might be foiled by a convoy's defensive changes of course. But when subs prowl in packs, any one, though itself out of range, can signal ahead the course and speed of the convoy, and thus arrange for the ambush.

But submarines have a weak-

Whirling propeller of fighter causes halos of condensed moisture—a rare sight even at sea where all sorts of baffling atmospheric conditions occur. Below, death bait for a Nazi sub





In a pinch, an escort carrier can do almost anything a full-sized carrier can do, except that most important item, keep up with a task force. The baby flattops are not greyhounds; shepherd dogs would be a more appropriate canine parallel. But they are combat ships none the less, even though they started out life as merchantmen.

There are two chief types of escort carriers, those converted from the merchant ship class known as C-3, and those built by the Henry Kaiser shipyards as carriers but on a modified merchant ship hull. They have several

With bomb bay doors open, an Avenger lets go a lethal load. Below, death throes of a sub settling by the stern after Avenger attack.

Official U. S. Navy photos

ness that proved fatal when the United States began hunting them from the air. Though while submerged a sub cannot itself be seen, neither can it see. And, submerged, its speed is too slow to permit much maneuvering. Again, it must surface from time to time to recharge the batteries it uses for power while submerged.

The fact they must come to the surface, where they can be spotted from the air, makes submarines vulnerable. And to take advantage of this fact, the escort carrier was born.

It takes skill to land on "postage stamp" deck of pitching flattop





Signal officer of midget flight deck sways with motion of landing Avenger. Below, formation ready to launch attack

functions. First of all, the matter of keeping enemy submarines down, at least until the escorted convoy safely passes—or blasting out of the sea those subs unlucky enough to start their crash dives too late. They are also used to ferry planes, ready-assembled, to battlefronts. The midgets help train combat crews, airmen and service personnel alike. They also back up the forces of invasion.

Although they cannot match the pace of destroyers, cruisers and battlewagons, the babies can throw lead and bombs at an enemy ashore. A pocket carrier among the ships that pried the Japs off Attu for a time provided, single-handed, the American air umbrella, when fog kept Army aircraft grounded on Amchitka, 240 miles away.

Though almost constantly fog-bound herself, this baby constantly sent her Wildcat fighter pilots to strafe and bomb Jap dugouts, fox-holes and machine gun nests. The Yank airmen would dive through rifts in the fog, cut loose with their guns, then lose themselves in the





"Cut throttle and proceed to normal landing," officer signals to incoming pilot. The "talker" (foreground) relays orders. Below, scout plane drops message to alert deck crew

fog again before the Jap anti-aircraft could range on them.

But it's out in the convoy lanes that the pocket carriers have best proved their worth. How many submarines have been sunk? Hitler would like to know; so would Tojo. But the number is not so important as the fact that the convoys are getting through. In the attacks by the Wildcats or Avengers, the planes most often found on baby flattops, results are often classified as "probable" or "very probable" when there is overwhelming evidence the sub was actually destroyed.

So cautious is the Navy in scratching the U-boats officially that pilots on anti-sub patrol say: "To get credit for a kill you've got to bring back the submarine's periscope or its captain's hat."

Evidence of certain "kills" of submarines may be as grisly as that picked up by one destroyer, after depth-charging a U-boat. In the oil that bubbled to the surface also emerged torn bits of human flesh, a smoking pipe and—appropriately enough—a German translation of Poe's "Murders in the Rue Morgue."

One Avenger pilot actually claimed "the captain's hat." Spot-





Men on wings balance plane so dolly can be put under broken gear after landing on pitching deck

ting a submarine on the surface far off the convoy's port quarter, the pilot kicked over into a vertical dive and placed all bombs in his salvo directly under the U-boat's stern. The stricken sub went under, and damaged beyond control resurfaced at a steep angle before it began its final plunge to the bottom. Crewmen popped out of the conning tower, and a destroyer that sped to the scene picked up evidence sufficient for the most cautious—21 enlisted prisoners, two minor officers and the submarine skipper himself.

A subsequent attack from this same vessel—which loosed 11 assaults on wolf packs in almost continuous action—also

Continued to page 152



On hangar deck, a tin fish is prepared for belly of Avenger. Below, Kaiser-built escort carrier of the Casablanca class



Sailors Wear Fire Breathers To Walk in Blazing Oil ⁰³⁰



Asbestos suits which have a self-contained breathing apparatus as protection against smoke and fire are worn in the British navy's new fire fighting school. Eventually every sea-going Royal Navy man is trained at the school, which includes practice in walking through blazing oil and quenching flames in compartments that are replicas of those aboard warships.

Hypodermic Needle 'Weights' Oil For Pivot Bearings on Gyro ⁷⁷⁹⁶⁷

Delicately balanced pivot bearings on aviation directional gyros are oiled with a hypodermic syringe. Calibration on the



*Electric Auto-Lite Co.
Tahleah, Ohio*

syringe allows a high degree of accuracy in measuring the oil used. In addition to "weighing" the oil, the syringe prevents dust from getting into the bearings.

Chemists Detect Real Rubber By Phosphorus Content ⁰⁶⁶

Two methods for detecting natural and synthetic rubber, and determining the proportion of each kind in a tire or other article, have been reported by the American Chemical Society. One method is measuring the amount of phosphorus in the rubber by ultraviolet spectrochemical analysis. Synthetic rubber has little or no phosphorus, while phosphorus is one of the minerals present in rubber trees and plants and therefore is found in various amounts in all rubber. The second method is by study of infrared spectra, which determines what substances are present by the way they absorb infrared radiations.

"Crutch-Seat" Helps Injured Learn to Walk Again ⁰²⁹



Convalescing servicemen should find it easier to walk again by means of a new crutch which doubles as a seat. Whenever the soldier or sailor becomes fatigued, he can open out the seat and rest. The device was developed by the Crosby Research Foundation, of Pasadena, Calif., in collaboration with Harry Botkin, a manufacturer. Bing Crosby, movie star, discovered the need for the combination crutch and seat while singing for servicemen in hospitals.

Mystery of Big Nazi Gun Probed by Russians

When the advancing Russians broke through the German lines, they were able to uncover the mystery of the huge siege mortars which the Nazis had employed to pound Russian cities and towns. Captured intact, one of the guns was shipped to Moscow for study by Supreme Red army and navy commanders and by engineers of the Russian Ordnance departments.

International News

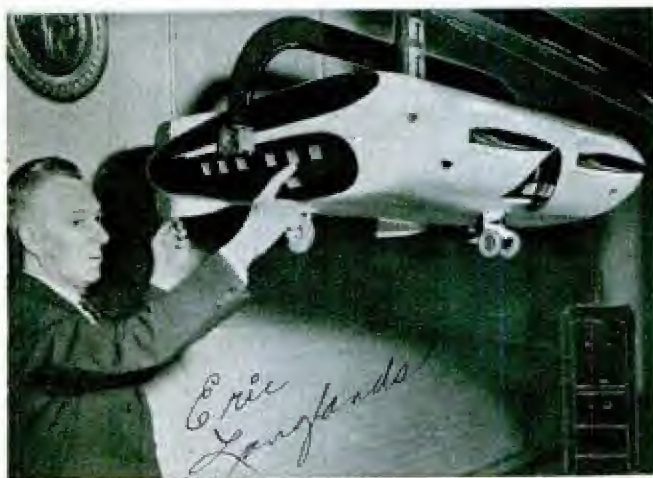
Rubber Walls to Heat Homes And Insulate Against Shock

Constructing skyscrapers on huge rubber blocks would be an ideal way of insulating them against vibration and shock in heavily congested areas, in the opinion of Russell Hopkinson, assistant director of business research for the United States Rubber Company. Hopkinson explained that rubber will retain its resilience almost indefinitely if kept away from sunlight, heat, oil and gasoline. He said large drop hammers and presses have been equipped with rubber pads with the result that practically all vibration has been eliminated, and an entire room recently was sound-proofed by mounting it on rubber. Rubber as a low cost heating device is now a practical application for summer cottages and homes, where large panels of conductive rubber or plastic are built into walls.



Huge Jet-Propelled Wing Called Future Airliner

Since jet propulsion has proved successful for planes of average size, airliners of the future will be jet-propelled flying wings, according to Eric Langlands, inventor who recently exhibited a model for this type of aircraft in Washington, D. C. Langlands explained that the principle is the same regardless of the size of the plane. Air is sucked in the front of the ship, highly compressed by heating and then ejected through vents in the rear.



Four Guns on "Wasp Wagon"

Four .50-caliber machine guns geared together for a firepower up to 2,000 shots a minute are mounted on a power-driven turret atop the M-16, or "wasp wagon," one of the Army's newer mobile anti-aircraft weapons. The turret can be operated in all directions and the guns fired while the half-track is traveling 50 miles an hour.



NETS *to* CATCH

074

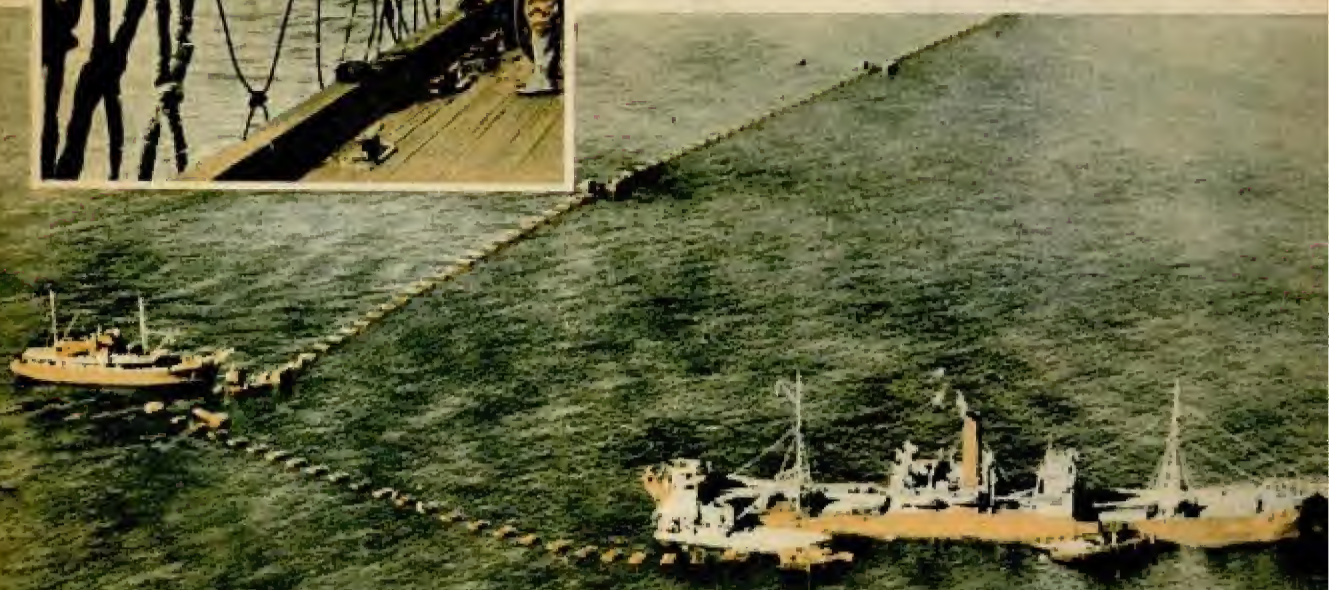
*Mr. G. H. Moore
1362 N. Dearborn
Chicago, 19, Ill.*



Crane lifts heavy net used to guard harbors and ships while men of the "Net Navy" inspect rings. Below, washing marine growth (left) from sub net



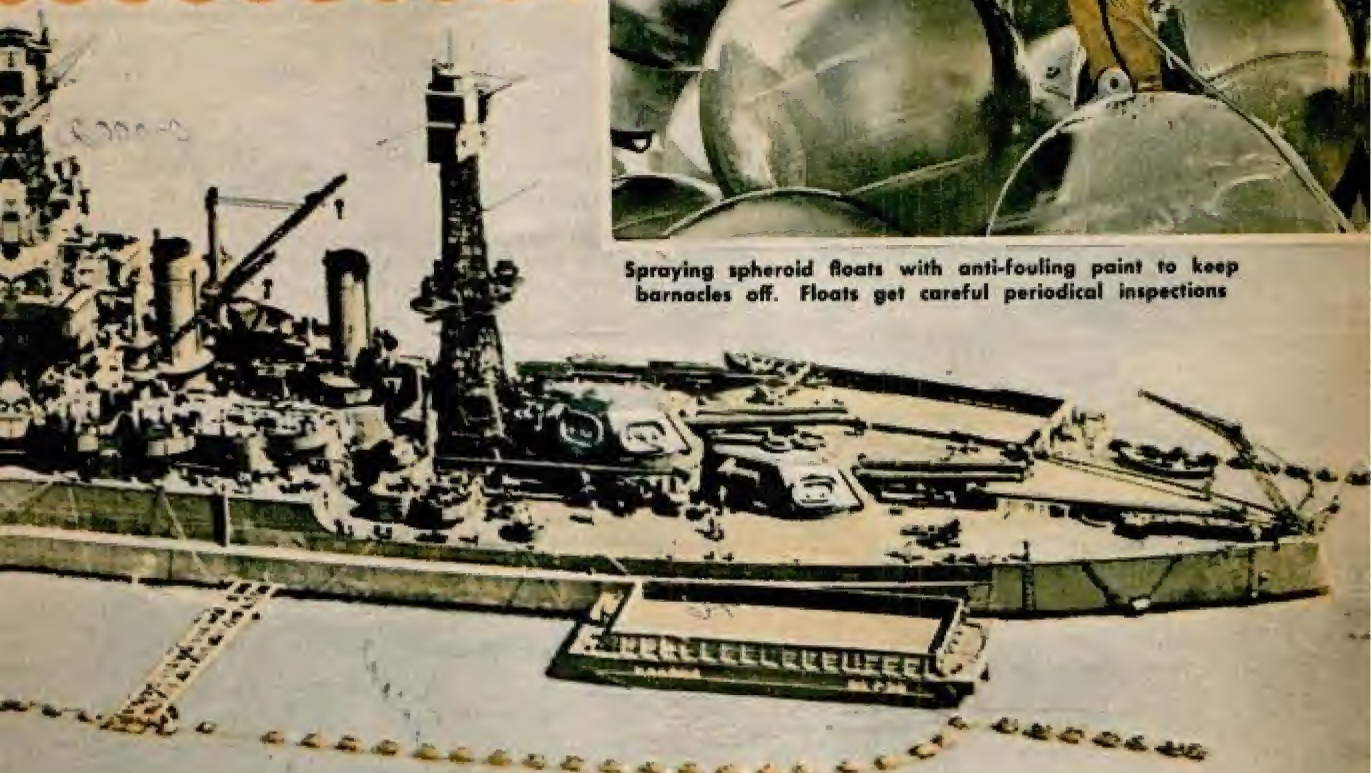
Anti-torpedo net around warship protects it from a sneak raid either when riding at anchor or tied up at the dock. Spars hold the nets away from the ship. Some nets are more than two miles long and extend from surface of the water to the bottom. Below, ships stand guard at "gates" of harbor which is ringed with submarine nets and anti-motorboat booms. Gates can be opened to let friendly vessels through



the **AXIS**



Spraying spheroid floats with anti-fouling paint to keep barnacles off. Floats get careful periodical inspections



Below, firing torpedoes at a net to test its strength. Right, net tender has a two-horned prow over which winch wires lower equipment





Air Hose Rigged on Broom Saves Time in Sweeping 046

Sweeping the floor is a less tiresome chore now at the Douglas Aircraft Modification plant, Daggett, Calif. One of the many "Handy Andys" developed there to improve efficiency is a broom with an air hose attached to it. By blowing the dirt along in front of the broom, the hose shortens the task of sweeping and saves much "elbow grease" for plant workers, particularly for the job of cleaning off an apron.

Soldiers Study Booby Traps While Working "Blind" 042

British troops in Italy are trained in the handling of mines and booby traps they can't see without resorting to darkness, as is done in some other "blind" training



methods. Sitting behind a board obstruction, the soldiers put their arms through stocks and under the watchful eyes of their instructors investigate the weapons which are screened from them. It is the final step in educating troops in all matters pertaining to mines and booby traps used by both the enemy and the allies.

Machine for Hanging Wallpaper Applies Paste, Trims Edge 0-0002

Wallpaper is pasted, trimmed and rolled into position for application to the wall with a machine invented by a retired Brighton, Mass., businessman. A roll of



paper is held at the base of the machine, and as it is pulled upward between parallel rods the paste is applied and selvage trimmed. All the operator has to do is sever the strip, smooth the paper into place and roll the machine into position for the next strip.

Unpainted "Forts" Are Faster

Flying Fortresses of shining natural aluminum are able to fly 10 miles an hour faster than bombers covered with the usual olive drab paint. The camouflage paint job on a "Fort" weighs 60 pounds. The silver Fortresses are said to be harder to spot against the clouds than the painted planes.

Giant Wind Tunnel Built for Testing Huge Propeller

When the Curtiss-Wright corporation put its new \$550,000 propeller-proving ground into operation recently at Caldwell, N. J., it tested a propeller which was 16 feet, 8 inches in diameter, the world's largest. Tests are conducted in enormous venturi, or wind tunnel, cells, each of which is built in the shape of a double funnel, with the narrow ends of the funnel joined, to insure a uniform air flow. Designed to be ready for the "propellers of tomorrow," the proving ground could easily test propellers up to 30 feet in diameter.



Model Airplane on Rotating Bar Does Barrel Rolls in Back Yard

Harold Austin, an inventor and employee of the Boeing Aircraft Company, Seattle,

Wash., constructed a miniature airplane and installed it in his back yard for his four year old son, Alvin, who has learned to "fly" upside down and do barrel rolls and banks. The plane moves in a 12-foot circle around a pivot pole at about 14 miles an hour. Balanced by sand bags at the opposite end of the rotating bar, the plane will stay in motion from 8 to 12 minutes after its quarter horsepower, washing machine motor has been turned off. Alvin does his maneuvering by shifting his weight inside the tiny cockpit. Materials for the invention were two carbide cans, two brake drums, 12 feet of pipe, and some scrap tin.

9608. 4th Ave. Pl. S. W.
Seattle, Washington



"Parent" of German Scare Weapons Rode the Waves in World War I

Remote-controlled glider bombs and rockets boasted of by the Germans may have had their inception in a pilotless speed boat developed during World War I. The craft carried charges of from 300 to 450 pounds of high explosive and was controlled from shore bases by means of electric cables. Germany had 17 of these cable-controlled boats, according to a report by

A. E. Sokol in the U. S. Naval Institute Proceedings. The speed boats carried from 30 to 50 miles of control cable and sufficient gasoline for a six-hour run at high speed. They were placed along the North Sea and Baltic coasts where 100-foot control towers were set up. Scout planes were used to signal the shore operators. Only one hit was scored with these boats.



MAGNESIUM- *The* LIGHTWEIGHT GIANT

Two-ton ladle of molten magnesium is lifted from an electric refining furnace. Below, a 25-pound magnesium casting used as mounting for cockpit control columns in allied plane



A SAFE bet is that none of your friends can name the third largest city in Nevada.

There are some 10,000 people in this city, yet you won't find it on your map. It is a modern community of air-conditioned homes with its own schools and churches, and it's so new that its inhabitants got around to naming it only a few months ago.

Two years ago Henderson, Nevada, didn't exist. Now it is the "lightweight metal capital of America." As much magnesium was refined there last year as was produced in the United States during the 27 years preceding Pearl Harbor. The plant of Basic Magnesium, Inc., is producing more magnesium than any other plant on earth.

Magnesium is the wonder metal that weighs one third less than aluminum and that has the greatest strength-weight ratio of all commercial structural materials. After the war you can expect to find it in your automobile, saving you money by the reduced weight

Mc. Stinson No 18

the engine has to pull. You can look for it in your kitchen where it will save money again because of its great heat conductivity when used as cooking utensils. You may find it in lightweight furniture, typewriters that weigh only a few pounds, and paper-weight vacuum cleaners.

At present, of course, all the magnesium that America can produce is needed for aircraft construction. Every piece of heavier metal that can be replaced by magnesium in an airplane increases the plane's cargo capacity. These days such cargo often consists of incendiary bombs and tracer bullets that are also made of magnesium. Right here is a good place to dispel a popular misunderstanding about magnesium's inflammability. Incendiary bombs made of it burn with terrible heat, but your future magnesium pots and pans won't catch fire. Solid magnesium can be ignited only by special sources of high heat.

Magnesium is one of the most common constituents of the earth and it also occurs in sea water and brines, but America produced relatively little of it until the war brought on a sudden, desperate demand. Of the plants



Welder cuts through solid magnesium to show that it resists combustion, except under special circumstances. Storage tanks (below) are at the Basic Magnesium, Inc., plant





Trucks haul crude magnesite ore from mine to adjacent BMI plant, largest of its type in the world

that were erected in a rush to produce it, the most unique in many respects is BMI, which is located 20 miles from Boulder Dam and about 300 miles from a huge magnesite deposit.

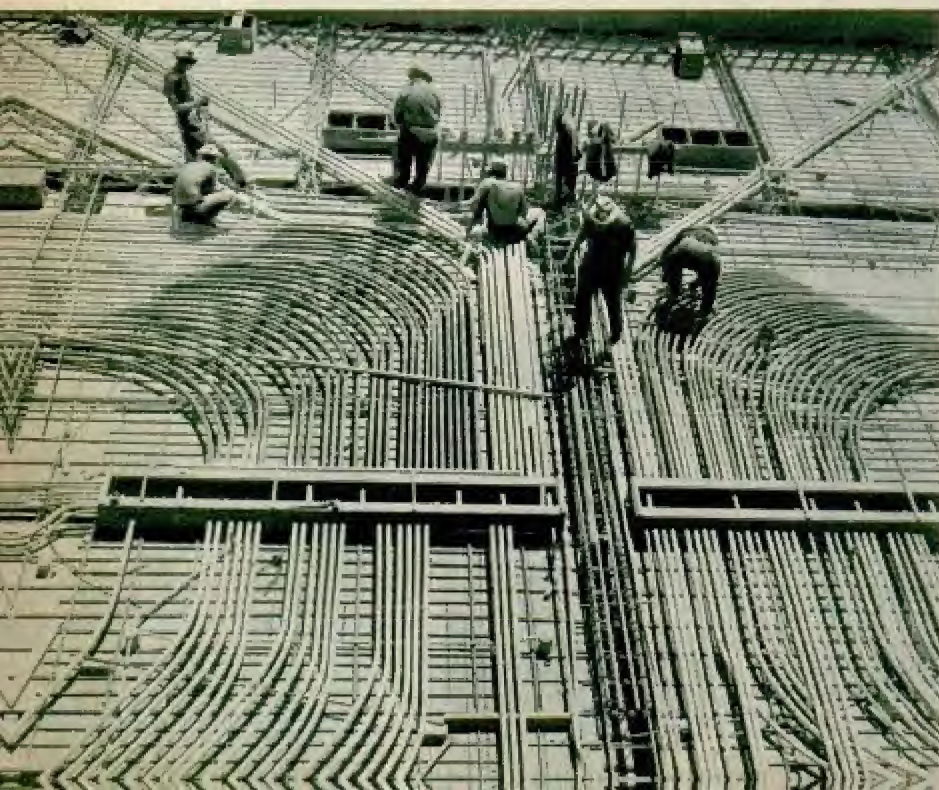
The BMI plant ranks among the greatest single enterprises ever built by man. It cost \$150,000,000. The plant, which is so big it could cover the entire business section of Los Angeles, has its own bus and taxi service inside the gate for transporting workers and officials on the job. It is using one third the generator capacity of Boulder Dam, enough electricity to light Los Angeles. Two transmission lines with a capacity of 230,000 volts each extend

from the dam to the plant. Its water requirements are on a similar scale and it draws its water from Lake Mead behind the dam from the end of a special cantilever bridge that projects out from shore. The electrical installation is second largest in the world and the air conditioning system, to draw off gases and maintain equable temperatures, is the world's largest.

Millions of pounds of copper were used in the electric installation but even this was not enough. Because of other war demands for copper, BMI borrowed some 20,000 tons of coin silver from the Treasury, shaped it into metal planks to serve as electrical bus bars, and installed it in the plant. The silver is worth \$23,313,000 and will be returned to the Treasury after the war. It is perfectly safe where it is in spite of its value. No one would dare to touch it, considering the heavy current that it carries.

Essentially the process used at BMI consists of changing magnesite, or magnesium carbonate to an oxide, then to a chloride, then breaking down the magnesium chloride into metallic magnesium and chlorine gas.

The magnesite is blasted out of a hillside in 10,000 ton amounts, is con-



Conduits and pipes under plant's rectifier building where alternating is changed to direct current

centrated, and shipped by rail or truck to the main plant. Here it is heated to drive off carbon monoxide, converting it to an oxide, and is then mixed with calcined magnesite, peat moss from Canada, coal from Utah, and special salts. After pellets of this material are burned to produce porosity they are placed in huge electric furnaces into which blasts of pure chlorine gas are also introduced, changing the magnesium oxide to magnesium chloride. The chloride, in a molten state, is then transferred to huge electrolytic cells where, under the influence of direct current, the molten magnesium metal collects in pools on the surface of the electrolyte. The metal is then cast into pigs and is taken to a refinery building where it is remelted together with fluxes that carry off any impurities. The refined metal is then cast into ingots.

BMI was designed to produce some 50,000 tons of magnesium per year. Today, under the management of Anaconda Copper Mining Company, it is producing more than 100 percent of its rated capacity. Magnesium is already cheaper than aluminum, copper, and other metals on a cubic foot basis. With further reduced costs, magnesium will be on a competitive per pound basis.

Magnesium is alloyed with other metals for most uses. Such an alloy may run 80 percent magnesium with various percentages of aluminum, zinc, manganese, or other alloying materials. One magnesium-aluminum alloy, for instance, is three times as strong as its weight in ordinary steel. Magnesium alloys are stiff metals of high machinability. They may be cast, die-cast, forged, extruded, welded, rolled, and fabricated in every known way.

Magnesium has been widely used in Europe in automobile bodies, truck bodies, and in lightweight railroad rolling stock in addition to its uses in aviation. Right now, it's called the "Victory metal." After the war it will be one of the new metals of peace.

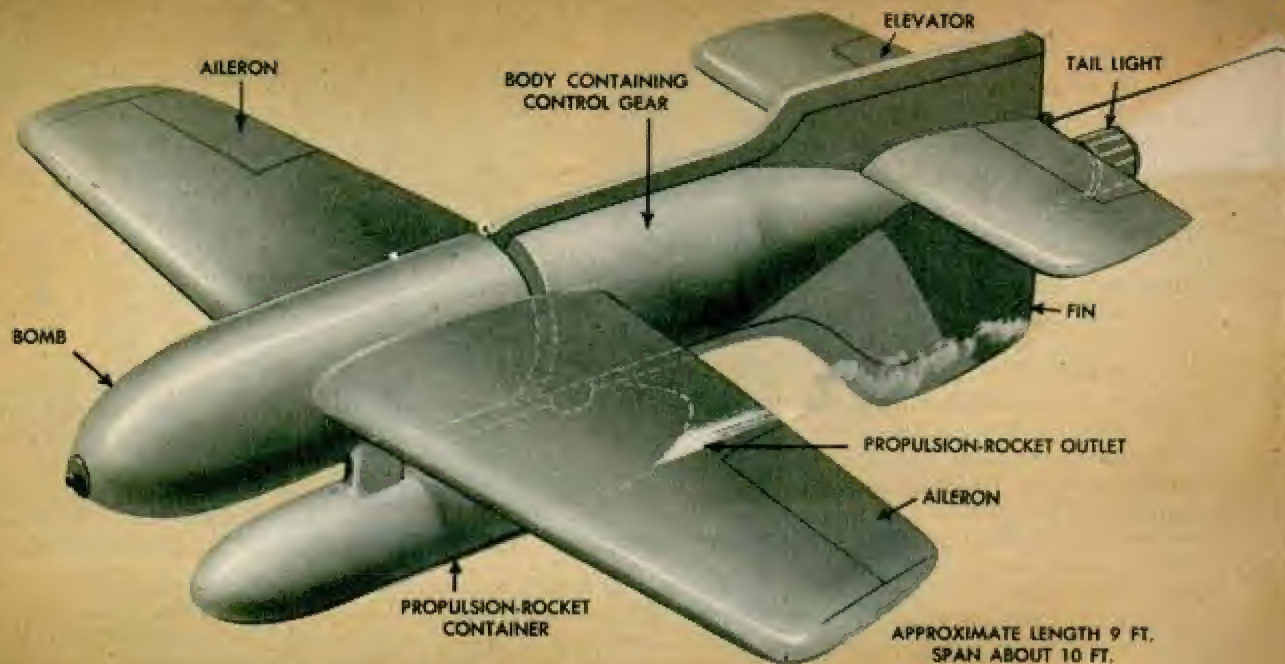


Finished bars of refined magnesium as they look when ready for shipment. The Nevada plant produces more than 50,000 tons a year



Lowering crucible of molten magnesium metal into cooling chamber. At Basic Magnesium, Inc., magnesite is changed into an oxide and then to a chlorine, which is broken down into metallic magnesium and chlorine gas. Below, water storage tanks under construction





LIGHT IN TAIL OF WINGED BOMB ENABLES CONTROLLER IN PARENT PLANE TO SIGHT AND GUIDE PROJECTILE

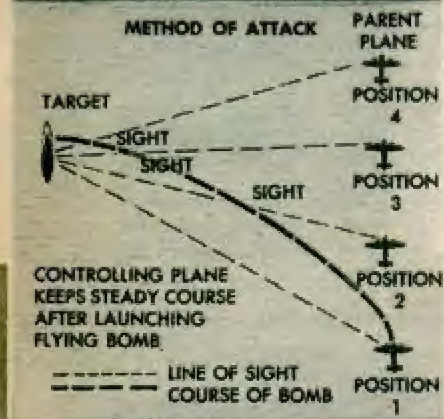


099

Pilot Sights Rocket Bomb by Tail Light

Details of the German radio-controlled rocket bomb shown on this page are based on the description of an eyewitness who was on board a ship attacked by this weapon. The explosive head is the shape of a standard German bomb, and the rear part of the body carries electrical receiving gear and relays for controlling its flight. The rocket which provides the propulsion is carried in a separate case beneath the bomb. A bright light on the tail enables the operator in the parent plane to keep it in sight and guide it toward the target.

Illustrated London News
P. 73 - Jan. 15, '44



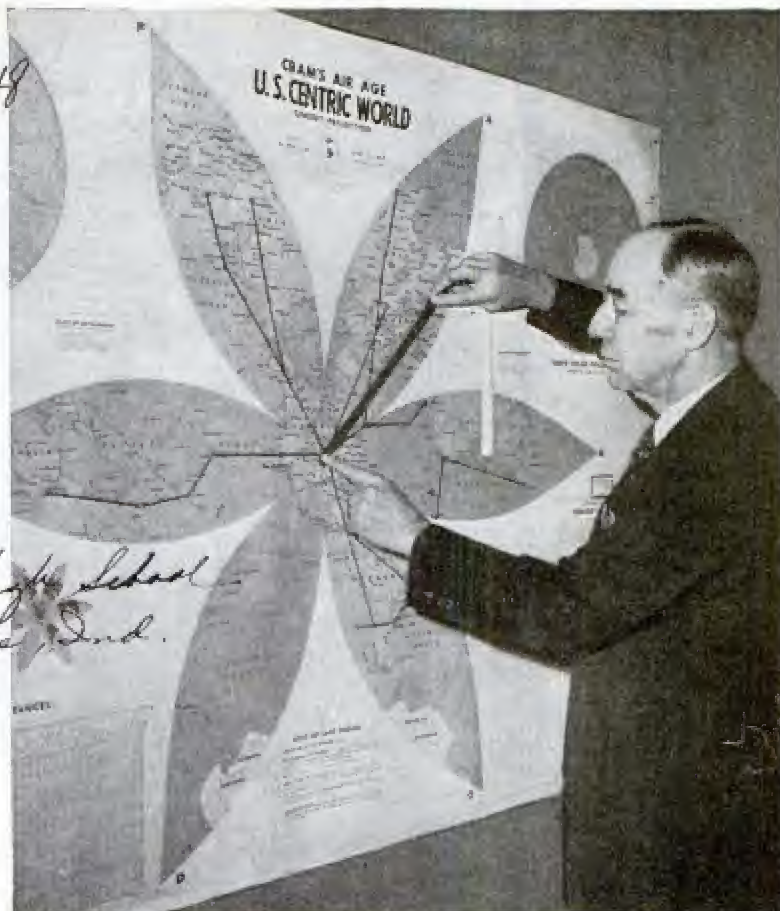
Star-Shaped Map For Plane Routes Aids Navigators

71848

Resembling a six-pointed star, a new map hailed as a boon to air navigation presents accurate distances between points on the earth's curved surface. The map, which is composed of six gores with the United States in the center, is said to have the least distortion of any flat map. The projection is the work of Walter G. Gingery, an Indiana high school principal.

*Washington High School
Indianapolis, Ind.*

Air distances on map resembling a six-pointed star are accurate due to compensation on the flat surface for curvature of earth. The U.S. is placed in the center of six gores which form the map

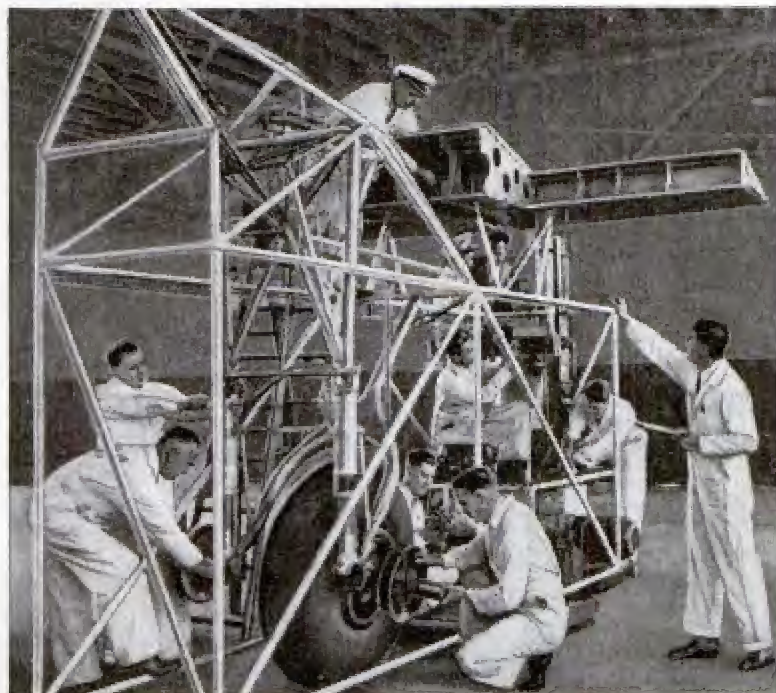


Mockup of Plane's Hidden Hydraulic System Helps Train Mechanics

71839

At a United Air Lines school for mechanic helpers is a mockup of the complete hydraulic system of one of the air line's big transports, showing the students the many

complicated hydraulic installations that, in actuality, are hidden in a plane's wings or fuselage. Mounted in a scaffolding of tubular steel is half of a landing-gear section,



including a full regulation wheel and axle, upper and lower truss and dragstrut, latch mechanism and warning system, and braking system. The pilot's cockpit is located directly behind the landing gear assembly, and directly overhead is mounted a wing section enclosing the heart of the hydraulics operation, the wing-flaps and automatic gyro pilot. Pressure needed for operating the mockup is created by an electrically driven pump.

Damage caused by rats in the United States during 1943 is estimated at more than \$200,000,000—an all-time high.

JUNE, 1944

*Marshall Airport
Chicago, Ill.*

49

HORNY-HANDED HEROES



A GROUP of Marine Raiders, according to a recent Associated Press dispatch, carefully approached a South Pacific island. Rifles were cocked and murder was in their eyes. They were out to clean up Japs.

As they came ashore, they saw what looked like an American Navy officer coming down to the water's edge.

"Hold your fire, men," said the Lieutenant Colonel of the Raiders, "this may be a trap." But the Marines saw a wide grin on the Navy officer's face.

"Good morning, Colonel," he said, "the Seabees are always happy to welcome the Marines!"

The flabbergasted Marine officer grasped the outstretched hand of welcome but all he could splutter was: "Well I'll be damned!"

The Seabees had scouted the Jap-held jungle island and surveyed airfield sites even before the Marines came in to secure it. Bulldozers, power shovels and trucks were quickly landed; within nine days, American pilots had a fine airfield on the island.

Seabees are trained like Commandos; their motto: "We Build, We Fight." Below, bayonet drill





Seabees learn to thrust and parry as skillfully as Marine Raiders. Their ranks are drawn from 69 building trades; below is one of the young navy engineers—a chipper



This is only one of many stories of intrepidity and courage concerning the Seabees—the horny-handed heroes of the Navy. Although the youngest branch of the Navy, the Seabees are already full of tradition. Steelworkers, hard-rock drillers, bulldozer operators, loggers and steamfitters—men given to artistic cussing, accurate spitting and tall-story telling—they are the stuff heroes and legends are made of.

The Seabees are plenty tough and they don't care who knows it. Two husky Seabees on a South Pacific island went hunting for Jap souvenirs during liberty hours. They wanted something to take home to their girl friends—a Jap flag, a Samurai sword or a tea set. Instead they found two rifles and an ax—with Japs attached. Unarmed, the Seabees went into action with their fists. When it was over, one of the Japs was dying, hit over the head with his own rifle. The other fled into the jungle, bullets from his own gun buzzing around him. The Jap rifles made good souvenirs—even though not what the Seabees were looking for.

The first Seabee battalion came into being shortly after



Seabee machinists team up on a drilling job, above

Pearl Harbor—although the plan of organization had been worked out two months before. The assaults on Wake, Guam and Cavite, and the killing and capturing of civilian workers, convinced the Navy their construction battalions should be in uniforms. So the Seabees were created, for the purpose their motto indicates—"We build—we fight."

The Navy originally planned a single Seabee regiment of three battalions totaling 3,375 officers and men. It later raised its sights to 18 battalions, finally 200. Today there are more Seabees than the total manpower of the entire Navy in pre-World War II days.

Seabees were with the Marines when they hit the beach on Guadalcanal. Seabees went ashore with the first troops in North Africa. Seabees went to the Aleutians to build docks, airfields and hangars, hospitals and barracks for Navy men. Seabees were in the landings on Sicily and Italy.

Here's one of the stories from North Africa: A French train was transporting ammunition and dynamite from a Medi-

terranean port to troops inland. Suddenly a Seabee guard spied smoke rolling from one of the cars. He tried to go forward to inform the engineer, but no luck. So he called his four buddies and quickly explained the danger of the train blowing up.

"Come on you guys," he said. "We're going to put out that fire."

"Are you crazy?" asked one of the others.

"Yeah, but let's get goin' or we'll be too late."

The five Seabees crawled back to the boxcar, which was smoking violently. They could hear 30-caliber ammunition beginning to explode. With the



The dragline operator, who learned his trade on the highways of Texas, had skill the Seabees could use

train rattling across the desert, the Seabees finally opened one of the doors and got inside to smother the flames. They were cited for heroism.

Seabees are experts at repairing and construction. Their proud boast is that they can fix "anything from a wrist watch to a battleship." After a battle with Jap warships, an aircraft carrier put into a South Pacific port for repairs. A group of 75 Seabees were assigned to the big ship because regular ship repair men were not available.

Just as the work started, the flat top received orders to put back to sea immediately and engage the enemy. The carrier

Continued to page 150



A welder does a repair job. Hundreds of welders were schooled in industry; the Navy trained others

—Directed by an officer, a group of Seabees hauls to the shore one of the Navy's big landing barges

A Navy variation of the Nissen hut goes up in fast time. These huts are used from tropics to the Arctic



7892

Fast-Action Metal Shrinker Operates Like Hand Pump



Unit can be mounted on bench; top, samples of work

Metal shrinking work that formerly required hours can now be accomplished in minutes with a portable, manually operated device. Worked with a pumping motion, the unit shrinks angles to a radius as small as three inches, and can be used on angles up to one inch wide. It handles metals of .016 to .051 inches without adjustment, and has reversible, hardened steel jaws for longer wear. The unit is compact, and can be mounted on a bench, on a stand, or in a vise.

Absolute Zero Brought Nearer By Magnetic Attack on Atom

Hope that a new world's record for low temperature can be set by attacking the disorder hidden in the nucleus of an atom has been expressed by Dr. Peter Denbye, Dutch Nobelist in chemistry and professor and chairman of the department of chemistry at Cornell University. The record is a thousandth of a degree Centigrade above

absolute zero. To drop the temperature below about one degree of the absolute scale it is necessary to use paramagnetic atoms which contain interior spinning electrons that are in a disordered state with respect to the directions of their magnetic axes. When a magnetic field acts on these spinning electrons, it puts them in order and in doing so the substance takes up heat, causing the temperature to drop. This was the method used in getting 0.001 degree K (representing Kelvin, the absolute scale.) The problem is how to use somewhat the same method in obtaining a still lower temperature. If the magnetic properties of the nucleus of the atoms are used, instead of a cloud of electrons about the nucleus, Dr. Denbye believes that a closer approach to absolute zero will be attained.

7894

Remote-Control Cutter for Wire Operates by Pulling Rope

Electric wires are cut at a safe distance with a "long arm" cutter that is operated by remote control. Jaw and blade are mounted on the end of a pole, and the cutting operation is performed by pulling on a rope. The handle of the cutter is insulation tested for 75,000 volts per foot. The jaw is slotted to hold the wire firmly in position and handles heavily insulated wires up to No. 4 hard drawn copper cable or mild steel rod.



Navy Anchor Chain Withstands a 900-Ton Load



U. S. Navy photos

Modern Navy anchor chain is made by the die lock method, by which two sections of steel bar, bent into U-shapes, are fitted together, heated, and sealed into one unit by huge drop hammers. Right, above, showing how two half links fit together. Below, removing "U" from forge furnace; socket holes will be punched in each end. Top, knives of big press trim excess metal and burrs from a finished link. Right, a maze of 3½-inch chain awaits shipment. Right, below, aircraft carrier chain in strength-test pit is also tested for proper length. Heaviest chain will withstand a load of 900 tons



Strength of anchor chain in testing pit is gauged by a machine that exerts a 2,000,000-pound load, below



Biggest Navy Yard

Firing Range "Mined" to Recover Scrap Metal



Huge quantities of war-vital metals were recovered at Fort Knox, Ky., by workmen who turned "miners" to salvage spent bullets from a firing range used for 20 years. The metal has a high content of lead and copper with small portions of nickel, tin, zinc and antimony. It is worth about \$100 a ton. The spent bullets were buried deep in a high dirt bank behind the pit where the targets are raised, and the soil contained about 190 pounds of metal per cubic foot. Thousands of pounds of the salvaged metal was stored in bins (left) before being sold to a private firm. Below, hydraulic pressure and screen washing removed mud from the recovered scrap metal



Armored Command Signal photos

Left, closeup of the recovered metal after it has been washed clean of any foreign substance. The view below is from the pit behind the targets which are moved up and down by soldiers during practice. The dirt bank on the other side of the pit is where the bullets are stopped. The metal was salvaged from a similar bank. Lower left, soldiers in kneeling position on the firing line at Fort Knox. Each soldier has an experienced coach and scorekeeper



Capt. Det. Lt. McDaniel, Sgt. Post, Public Relations Officer, Adapted from Knox, Kentucky.

TABLE TOP WAR MOVIES



HOLLYWOOD, entertainment center of the world, can now call itself the world's greatest university. Some eight or ten million people are in its student body. By means of motion pictures it is teaching special aspects of the military sciences to the armed forces.

Its training films range from simple sight-and-sound explanations of how to maintain and operate weapons to "feature" films by which battle tactics are taught. Most prewar training films were dull and drab; now movie technicians are using all the tricks of their trade to impart life and realism to their instructional pictures.

Actual newsreel combat scenes, specially staged shots of actors on sets, animated drawings, miniatures, and special effects of all kinds are used to drive home convincingly the points that are being taught in the pictures. Such films give men a quick and thorough grasp of what they are being taught and why, and may slash training time by as much as 40 percent.

Craftsmen make houses for a table top movie. They will look life size on the screen. Below, George Pal, head of Pal Productions, with lighthouses and buoys for film on navigation





Lightship at right is 4-inch replica of an 18-inch miniature. Below, distorted model will look normal when "shot" at low angle



You can't order up a fleet of warships to make a picture demonstrating naval strategy, nor can you ask the Army for a few dozen tanks just because a picture calls for them. War equipment can't be spared and it would be a long, tough job to make such scenes in full scale anyway.

To learn how it's done, let's go behind the scenes at George Pal Productions. Pal's staff, trained in making the "Puppetoon" shorts that you've seen on the screen, today is turning out training films along with its regular production. In this studio a naval battle may be under way in one room, while on an adjoining stage realistic tank warfare is being conducted.

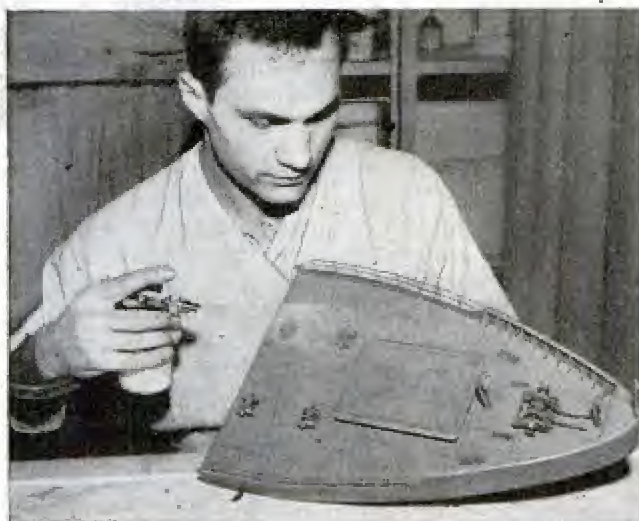
The sea battle is being fought on a table top, on an ocean that consists of a sheet of ripple glass. The ships are scaled-down models. The camera takes you up in the air to give you an airplane view of the engagement, then down to the surface to pick up and emphasize a point that is being stressed in training.

The same technique is used in filming the tank maneuvers. Pal compresses 10 square miles of battleground into a miniature set that

measures 9 by 14 feet. It duplicates typical country in which tanks might be used, with painted plaster for the ground, twigs and branches for trees, miniatures for buildings, and real pebbles for rocks. Tiny tanks only three-quarters of an inch long but complete down to guns, radio antenna, and insignia, maneuver across this terrain, charge enemy installations, and even fire their guns. For technical reasons the set was tipped at a 50 degree angle for filming and 12 technicians and two cameras were used.



Rehearsing a naval battle on "ocean" of ripple glass. - Below, spray painting bow of a miniature freighter



Don't think for a minute that the finished films look like pictures of toys that are being moved around to demonstrate how battles are fought. On the screen you get the impression that you are actually seeing full sized battleships or tanks at work. Carefully chosen camera angles is one of the ways in which this illusion of reality is created. Some scenes are purposely stylized by eliminating all distracting details.

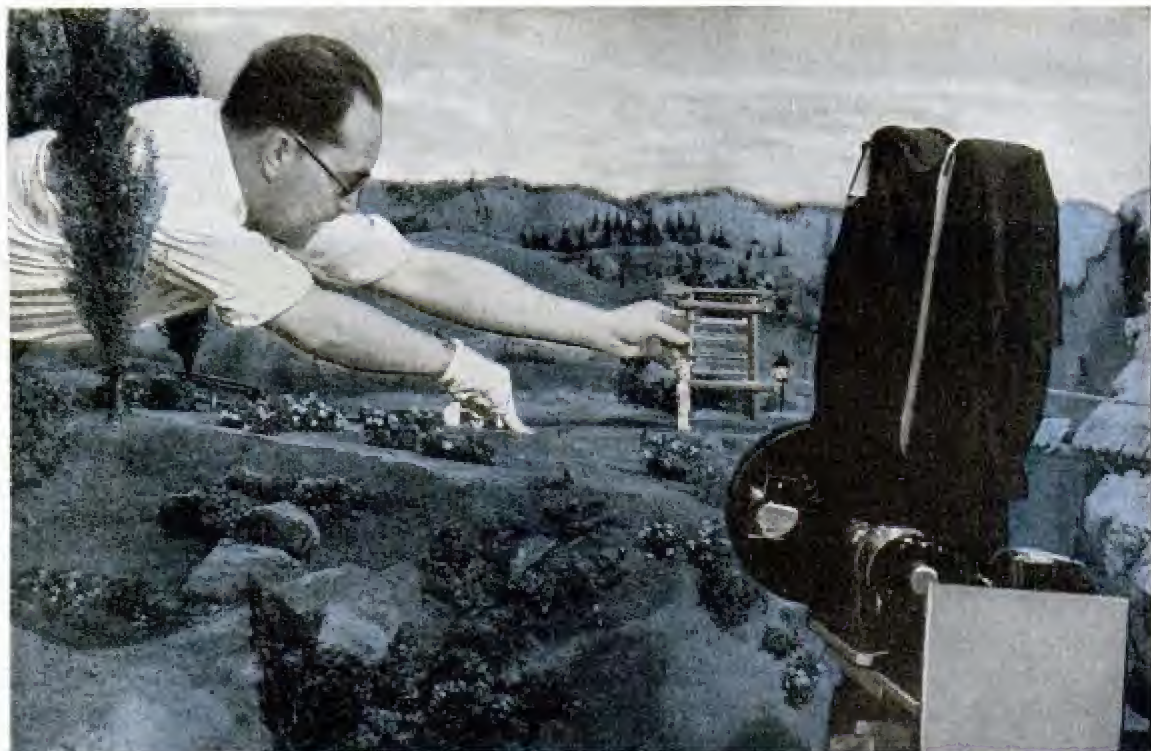
One recent assignment at the Pal studio was to make a picture that in 30 minutes would teach most of the fundamentals of coast-

wise navigation. The picture was to demonstrate, and to explain on its accompanying sound track, how lighthouses, bell-buoys, channel markers, and other aids to navigation should be used. The picture was to be in color and was to show after dark as well as daytime scenes.

Pal started out by building exact miniatures of the ships, lights, and buoys that the script called for. One lightship was



Pianos, violins and other miniature instruments must be made for realistic settings



Objects are moved a step at a time between camera frames to produce animation on the screen

made in an 18-inch size, then reproduced in a four-inch model for long shots. Some of the buoys were made in four sizes ranging from seven inch "giants" for close-ups down to half-inch duplicates for shots in the distance. "Grain of wheat" electric lights were installed in the lighted buoys and were wired to flash on and off. The lighthouses were built complete to Fresnel lenses cut from clear plastic disks.

Plastics, wood, and metal are the materials from which miniatures are made. Cloth, thread, and string are taboo because they are apt to change shape under the hot

lights. The finished miniatures are painted with colored lacquer.

Animation of ships and other objects is by stop motion. That is, one frame of film in the camera is exposed, the ship is moved a slight distance on its course, another frame of film is exposed, and so on. The completed film when run through a projector at normal speed shows the ship in smooth continuous action. In producing color pictures Pal really makes three exposures on each frame, one each through the red, green, and blue segments of a color filter wheel mounted on the camera.

To animate a big miniature bell-buoy so that it pitches and tosses in the waves, the technicians place it over a hole that is cut through the surface of the artificial water and extend a rod attached to the buoy down through the hole so that it may be manipulated from below. The hole also conceals the wires for the buoy's tiny light.

The waves themselves appear to be in motion in the finished picture. This effect is achieved by reflecting undulating lights and shadows on the glass ocean. Combined with the rippled surface, the lights make the waves appear to sparkle and toss.

Shadows that mark the chang-



"Puppetoons" like these provided idea for table top war movies to instruct soldiers

ing sun are obtained simply by moving the main overhead light source, but a fog at sea and other weather changes are more difficult. In a picture you may watch a fog bank creeping along the surface and then concealing a ship. This is done by airbrushing fog paint on large glass slides and then moving them gradually in front of the camera across the scene.

Glass slides, too, are the secret of how guns can be made to fire in miniature scenes. The first small puff of smoke and flame is painted on a glass slide, a larger puff on a second slide, and the sequence is carried on to show the growing smoke cloud until it dies away in a lingering wisp. These slides, placed one at a time in front of the camera and matched up with the muzzle of the gun, give a realistic effect of firing.

In all miniature work, action, distance, and time must be cut down in scale to match the miniature set. Otherwise the sense of reality is lost. Before the movie makers film a scene that shows a ship approaching and then rounding a buoy they must first learn the size and speed of the vessel that their miniature represents. Then they can figure the number of frames of film that would be required to show the action in real life. That tells them just how far the miniature ship must be moved ahead between each succeeding exposure. Measurements must be followed precisely to avoid jerky motions in the finished picture.

Practically the whole motion picture industry has worked on the new training films. Other pictures have been made by the services themselves, using Hollywood techniques. The professional movie makers have demonstrated that they can inject color and interest into subjects that make pretty dull lecture material and that by motion pictures they can simplify and explain intricate operations that are difficult to grasp by reading textbooks.

Visual education was a pretty small department in the movie industry until the war came along, bringing with it the need for a quick method of mass education. It's working so well that "films that teach" will be seen more than ever, after the war.

JUNE, 1944

Twin Bikes Form "Ambulance" For Patient on Stretcher



Among emergency methods devised by British Home Guards to transport the injured or wounded is a one-patient bicycle "ambulance." The patient rides on a stretcher lashed to supports between two bicycles. This means of speeding the injured to a hospital or first-aid station is especially handy in heavily bombed districts. If the streets are pitted with bomb holes, the bicycle stretcher bearers take to the sidewalks.

J. North Wales

Fast Driving Saves Very Little Time But Cost in Lives Multiplies

Statistics to show that driving an automobile at high speeds is dangerous and unprofitable have been advanced by Harold F. Hammond, traffic director of an insurance executives group. Hammond said that at 20 miles per hour there are 12 fatalities in each 1,000 injuries, but at 51 miles per hour and over there are 92—more than a seven fold increase. To stress the high dollar cost of speed, he asserted that on a 1,000 mile trip increasing the speed from 45 to 55 miles per hour would save four hours but the extra cost would be at the rate of \$1.88 per hour. With a speed increase of 55 to 60 miles per hour, the time saved would be 2.8 hours at a cost of \$4.10 an hour, he added. He said that over distances of 20 miles an increase of speed from 55 to 60 miles per hour saves only 1.8 minutes, while an increase to 65 saves 3.3 minutes, and to 70 saves 4.6 minutes.

*Ass. of Casualty & Surety Companies,
60 John St.
N. Y., N. Y.*

FINISHING SCHOOL *for* KILLERS

*Combat School
Antiaircraft Artillery Training Center
Camp Davis, N.C.*



With machetes swinging, gunners in the close combat school at Camp Davis, N. C., charge across the field. The three-week course of Commando and Ranger tactics is so tough that only 20 out of 50 men finish. Right, "thrust and parry" maneuver breaks the dummy rifles. Below, man on ground tries to block thrust





† Men at right swing machetes over heads of opponents who had better duck—or else. Men at left come in low and spring at “foe,” in attempt to grab the machetes



“Rifle-butt” medicine is delivered to man caught off guard as a reminder of what can happen if Jap or Nazi catches him napping

Left, trainee who has jumped from speeding jeep is about to somersault to absorb shock. Trainees make the jump at 40 m.p.h.

Typical group limps back from the “get tough” training field after first aid has been administered by the medical corpsman (second from left). Note good-natured grins despite actual injuries



Electric Speed Indicator Co.
Cleveland, Ohio N 898

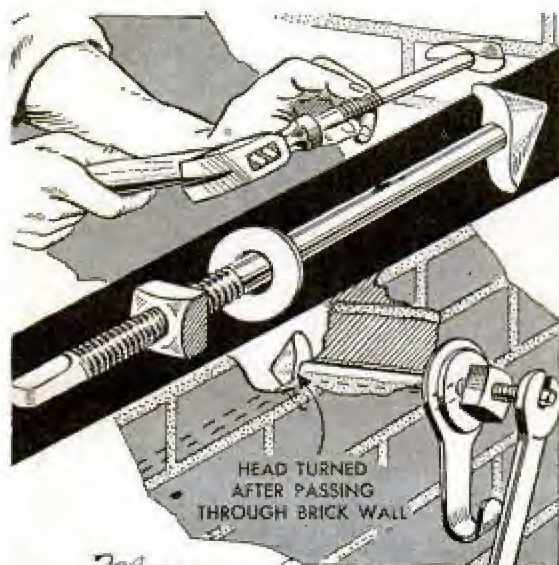
Portable 'Speedometer' for Wind Has Parts Made of Gold



Wind velocity is accurately measured with an instrument that can be moved about or permanently mounted. It consists of an anemometer-generator and an indicator. Commutator bars and brush contacts are made of gold to insure positive electrical contact at all times. The instrument is weatherproof.

Spear-Head Bolt for Brick Wall Anchors Firmly to Air Lock

Anchorage bolts for masonry walls have spear heads which hold them firmly in



Masco Company
418 Ohio St. Suite 601
St. Louis, Mo.

place. This type of bolt, which was recently patented, can be installed at small cost without damaging a wall. The spear head extends into the air space, or air lock, inside of brick walls which provides just enough room to accommodate the head behind the first course of bricks.

Rubber "Skin" Heats Propeller & To Keep Ice From Forming

Ice formation on an airplane propeller can be avoided by installing an electrically heated rubber "skin" on the propeller surface, so that it warms up like a sickbed heating pad. The new de-icer is made of a combination of two kinds of synthetic rubber, the outer surface being a thin coating tailor-made to conduct electricity instead of blocking its flow. The current comes from a generator attached to the shaft and the propeller can be kept warm and free of ice as long as the engine runs.

Phantom Photo Hidden in Card Double-Checks Identity



Invisible except when held against a strong light, a "phantom" photograph concealed within the paper of a tamperproof identification card makes it impossible to change or reproduce the card and provides a double check of its validity. The owner's name, photograph, fingerprint and other data are printed on the surface, the card being further protected by sealing it in a transparent cover. A duplicate of the photograph is deposited inside the paper by a secret process of the manufacturer, appearing like a watermark when inspected against a light.

LIFELINE *of the* FLEET

By Rear Admiral
William Brent Young, SC, USN

Chief of the Bureau of Supplies and Accounts
and Paymaster General of the Navy

DESCRIBING a recent action in the South Pacific, a war correspondent wrote that "in all directions stretching away to the distant blue horizon were ships of the United States Navy—battleships, cruisers, aircraft carriers, destroyers and countless auxiliary craft—as far as a man could see."

Extending to every ship in this mighty armada was a lifeline of supply thousands of miles long. Along this lifeline flow millions of tons of fuel, provisions, clothing and equipment, representing more than 60,000 items in the Navy's Standard Stock Catalogue, and additional thousands of special items.

It is the business of the Navy's Bureau of Supplies and Accounts to see that the fleet gets what is needed, where it is needed, when it is needed.

Booms of a transport
off Salerno swing a
loaded truck into LCT





This may mean providing fuel for a tanker rendezvous with an aircraft carrier. It may mean sending a vital part to a disabled vessel; designing and obtaining huge quantities of special clothing for the Arctic or the tropics; or supplying a battleship with general stores so it can remain at sea for extended periods.

The magnitude of this job is revealed in the provisioning of a single cruiser for a month at sea. The thousands of items which must be stowed aboard include 15,000 barrels of oil, 9,900 pairs of black cotton socks, 40,000 pounds of refrigerated meats; 11,000 pounds of butter, eggs and cheese; 25,000 pounds of fresh fruits, 74,000 pounds of fresh vegetables, thousands of pounds of dry provisions and general stores. The supply officer must know to the exact day when additional supplies will be needed.

Left, Naval Air Transport Service delivers engine to tactical squadron overseas. Below, LST crammed with materiel
Official Navy photos



Lumber is one class of material for which the Supply Corps assumes responsibility. In this day of metal ships, wood is still indispensable — for construction ashore, for floating drydocks, mosquito boats, harbor patrol boats, minelayers, minesweepers, buoy boats. Even the monster steel battleships require hundreds of thousands of board feet of lumber for decking alone.

Clothing is as important as ammunition to a Navy fighting in every clime. For



Battle station for supply officers is on bridge—favorite enemy target. Left, a flying boat of NATS
Courtesy Pan American Airways



one minor example, consider woolen socks. One crew of a Navy patrol bomber, marooned for 15 days in an Alaskan blizzard, with the temperature at 10 below and the wind at about 130 knots, survived without even frostbitten toes.

Special protective clothing has been devised for scores of uses, foul-weather gear for the tropics, winter garments for the Arctic, flight clothing for plane crews. But even dungarees and chambray shirts have "saved a lot of skins" from burns from flash explosions in battle.

Feeding the fleet is a major concern of the Supply Corps. We procure, transport, store and prepare everything the sailor eats. Experiments which the bureau fostered with the dehydrated food industry

LST's unload men and cargo on Cape Gloucester beach





Tractors, trucks and bulldozers race for Bougainville beach. Left, hoisting cargo

over a period of years came to a most satisfactory stage of development just about the time of Pearl Harbor. Today vessels are able to remain at sea longer due in large measure to supplemental use of dehydrated products.

New methods of packaging and storing supplies are devised daily. Spare machine parts sent overseas are now dipped in a preservative that prevents corrosion. This innovation, alone, will save an estimated loss of \$10,000,000 a year.

The responsibilities of the Supply Corps consist of "procurement, purchase, receipt, custody, warehousing, issue, and shipment of all naval supplies, except certain technical materials, notably ordnance and medical items, as well as keeping a record of the Navy's money and property." The bureau also pays the sailors.

During one month the bureau purchased \$2,344,000,000 worth of supplies—more than three times the amount of purchases by the bureau during all of World War I. Since Pearl Harbor the Navy has grown in manpower from 324,000 officers and men to approximately 2,389,000 on January 1, 1944.

Supply officers sail on every ship from destroyer up. Normal battle station for supply officers

Can of oil is hauled aboard Catalina patrol bomber lying alongside a mother ship

POPULAR MECHANICS



Loaded with 35,000 pounds of priority cargo, giant Martin Mars breaks record

is the coding room. More than one supply officer has been in charge of a battery. One of our officers saw action in seven major engagements in the Pacific, including the battles of the Coral Sea, Cape Esperance and Guadalcanal. He was on the cruiser San Francisco, which was cited for sinking a destroyer, disabling a battleship at a range of 3,000 yards, and damaging two other enemy vessels. He was so busy decoding messages during the fighting that



Unloading the Mars—hatch is hydraulic powered. Left, lashing down air freight



he did not realize the danger until an officer came down from the bridge and said:

"I think we can save the ship."

Afterward, he learned the casualties on the bridge included Rear Admiral Daniel J. Callaghan and Captain Cassin Young.

The advanced supply base is a veritable floating depot. There, guarded by a patrol of destroyers, PT boats and aircraft, by mines and nets, are heavily laden cargo ships. Fighting ships replenish their sup-

Continued to page 158

Control Panel on Giant "Mars" Is Maze of Dials



Engineers on the world's largest flying boat making a last-minute check before giving the "ready" signal

One record which the Navy's cargo flying boat, the *Mars*, broke before it ever left the water was for the complexity of instrument panels. The engineer's panel on the world's largest plane is a maze of switches,

Home News pictures
dials, gages, flashing lights and buttons. There are more than 70 dials alone. Recently, this ship, which is used to transport cargo to scattered outposts, carried 35,000 pounds of war materials on one trip.

Aircraft Motor Adapted for Bus Weighs One-Third Less

Designed to operate in desert heat or sub-zero cold, a modified six-cylinder aircraft engine can be used in buses or other motor-driven vehicles. It is air-cooled and weighs one third less than motors of comparable horsepower. The self-contained unit complete with clutch and fly wheel,

7955
develops 162 horsepower at 2,800 r.p.m. on 73-octane fuel, and weighs only 755 pounds. A 16-blade fan mounted integrally with the flywheel cools the motor and maintains the carburetor air supply at pressure above atmosphere on the intake side of a heavy-duty air cleaner. This "packaged power" unit is said to be economical to operate due to fuel efficiency, and is designed for constant use at 75 to 85 percent of full power. The engine operates successfully at temperatures from 120 degrees above to 20 degrees below zero.



This six-cylinder engine operates efficiently in extreme heat or cold

Five hundred pounds of bullet-sealing rubber are used in the gas tank of a Flying Fortress.

Cellophane Foxhole Guards Troops in Gas Attack

Yankee infantrymen "wrapped in Cellophane" can look an enemy fighter plane right in the eye as it swoops down in a simulated gas attack. At least, in training—for in the real thing they would probably be shooting from better cover than the troops participating in chemical warfare drill at Mitchel Field, N. Y. The Cellophane-like wrappers, compact and quickly donned, protect parts of the body not covered by gas masks.

Doughboys duck into their Cellophane bags as friendly strafer looses a jet of gas



"Merry-Go-Round" Sorter Has Trip Lever on Scales

Squares of optical glass, which must be weighed before being molded into lens blanks, are automatically sorted with a "merry-go-round" machine. The sorter, used by the Bausch & Lomb Optical Company, has 30 balance scales which move in endless procession before an operator who places a single square on each scale. A trip lever attached to the scale pan dumps the glass into the proper bin. The machine sorts 60 pieces of glass a minute with one operator turning out the work of 20 individual sorters.

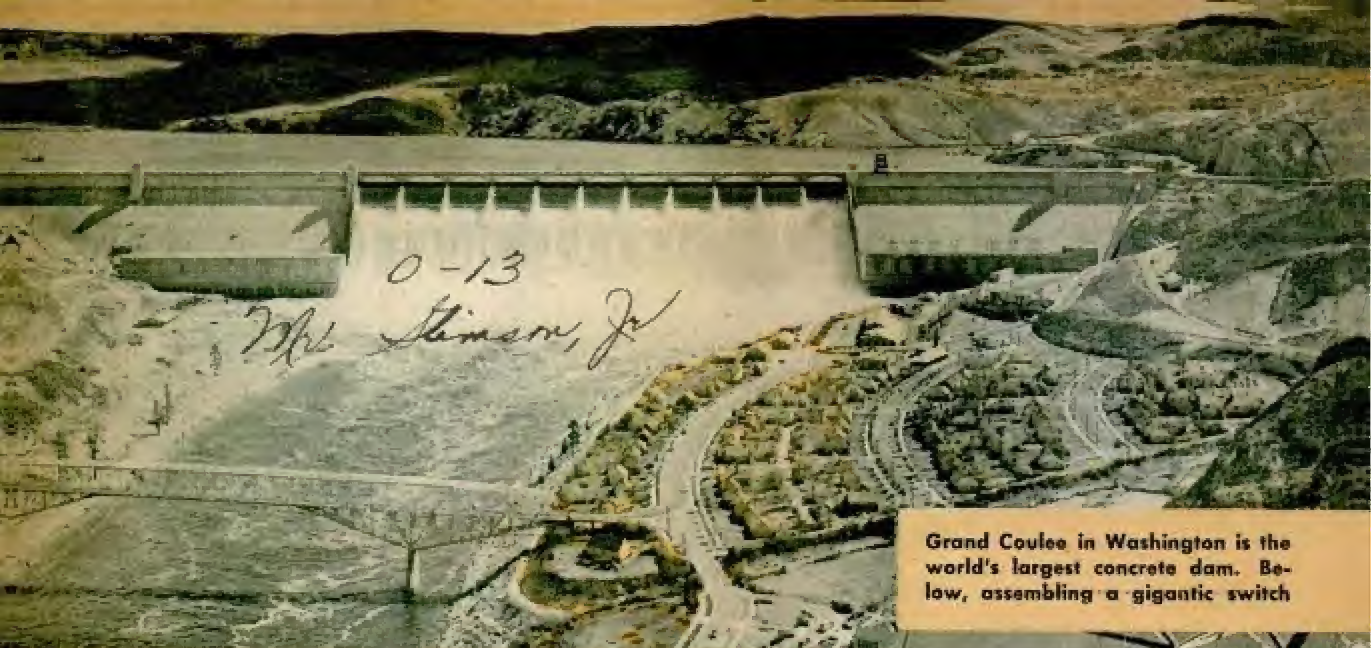
Rockaway, N.Y.

Jeep's "Follow Me" Sign Aids Plane Parking

Pilots in the 21st ferrying group of the Air Transport Command at Palm Springs, Calif., find it a pleasant task to park their planes. They merely follow a Wac corporal who leads them to the proper spot in a jeep with the words "follow me" painted on its back in large letters. The sign has another purpose—to encourage American women to follow this driver by enlisting in the Air Wac.

When an ATC plane is landed, the pilot looks for a pretty WAC behind a big sign





Grand Coulee in Washington is the world's largest concrete dam. Below, assembling a gigantic switch

SWITCHYARDS *for the* NATION'S POWER

A HEAVY rainstorm in northern California is of more than local importance, for it may set into operation a chain of events that has a final effect in Texas, half a continent away. The flow of natural gas or fuel oil from a Texas petroleum field may have to be increased solely because of a rainstorm on the Pacific coast.

This odd situation exists because of interconnections between electric power systems. Hooking the systems together makes it possible to draw upon distant sources

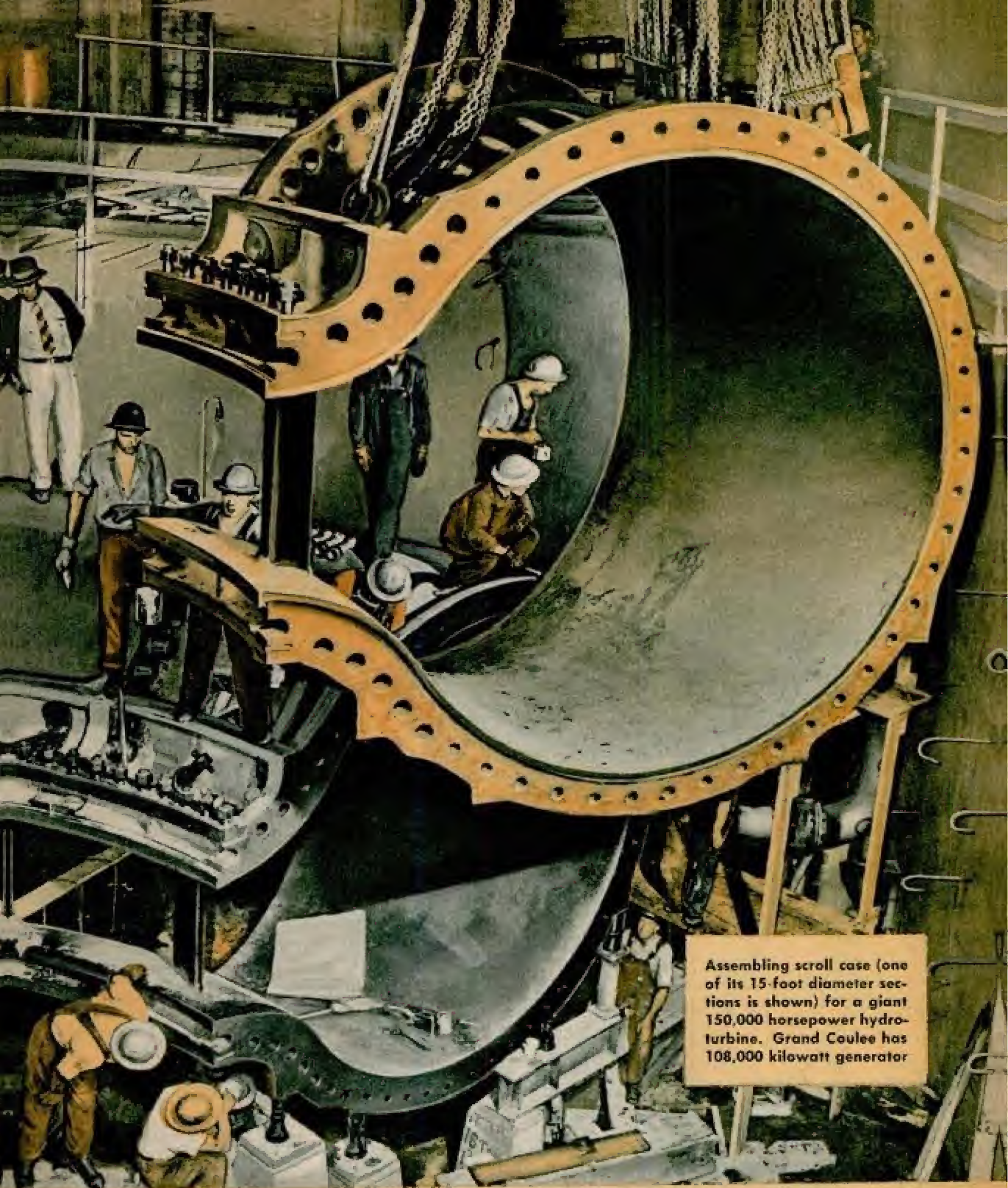


of power in times of need. Interconnections allow the electrical industry to balance its power sources so that the perpetual demand for electricity is constantly satisfied.

The full story of the tie-up between the California rainstorms and the Texas oil field is complex but a simplified outline might go like this: in anticipation of future needs, the public utility that serves the San Francisco area has been conserving the water in its northern storage reservoirs, meanwhile buying power from the Southern California Edison Company via a

Electric sub-station operator maintaining contact with a field lineman who reports over short-wave radio Southern California Edison Co. photo





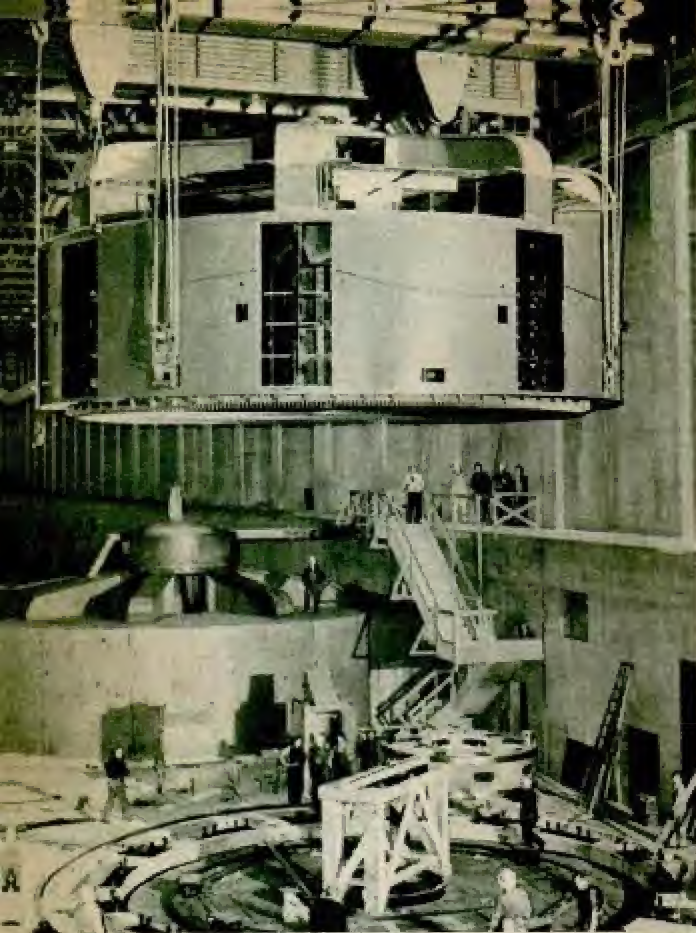
Assembling scroll case (one of its 15-foot diameter sections is shown) for a giant 150,000 horsepower hydro-turbine. Grand Coulee has 108,000 kilowatt generator

hydro-electric plant in the central mountains. When a big storm assures a surplus of water in the north, the San Francisco utility increases its own hydro-electric output and disconnects from its neighbor.

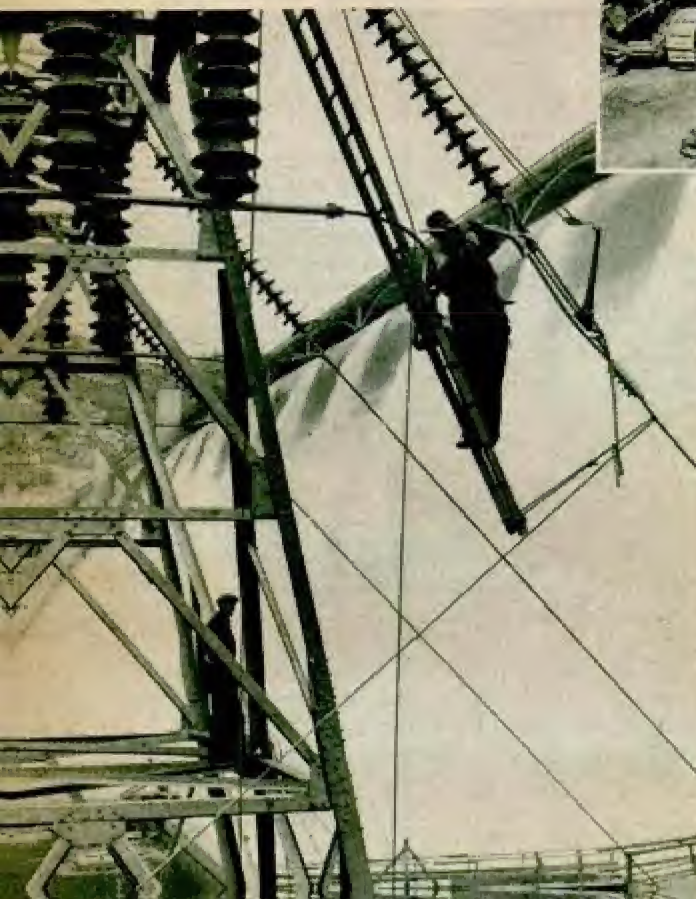
This allows the southern company to route the unused power over its transmission lines to Los Angeles and permits it in turn to reduce its demand on the generators at Boulder Dam in Nevada. Boulder,

accordingly, reduces the flow of water through its turbines, which curtails the amount of water that flows downstream to another powerhouse at Parker Dam.

The Parker powerhouse has a guaranteed minimum flow of water on which it can depend but in these days of high demand its turbines need every drop they can get. When Parker's generators slow down, the power companies in Arizona that are



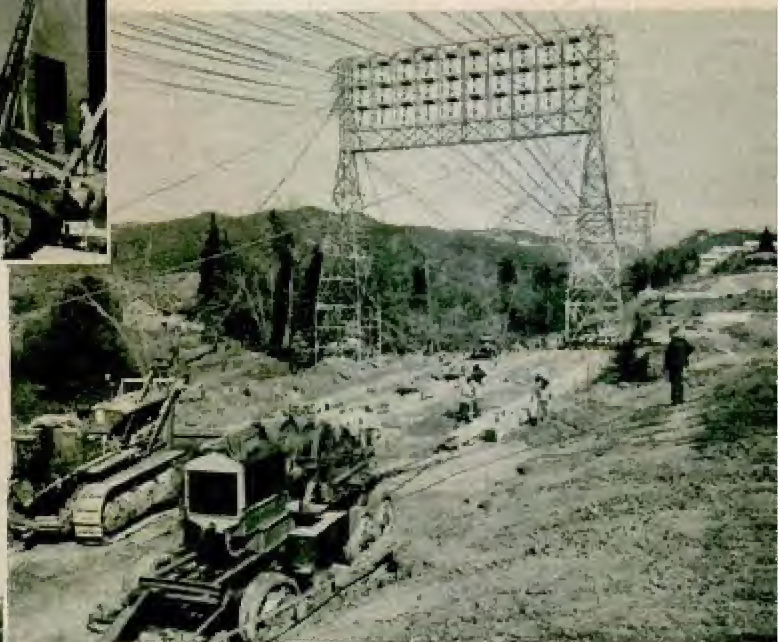
Lowering 220-ton stator of 108,000 kilowatt generator into Grand Coulee's powerhouse. Right, moving bridge-type transmission tower without interrupting flow of current through its 11 circuits. Below, electricians string cables that will transmit Grand Coulee power northwest



connected to Parker must turn to stand-by steam plants to make up the difference. These steam plants are the final link in the chain, for they burn oil piped from Texas.

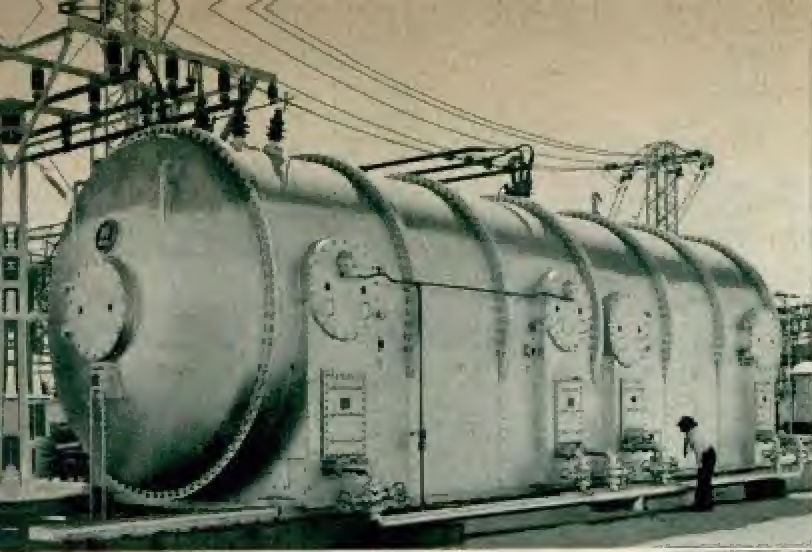
This example of interconnection is not far-fetched. It has even happened that power from Boulder Dam, flowing along transmission lines down into Mexico and west to the coast, has provided the initial link in a chain that made it possible for a power company in Idaho to meet an unusually heavy demand for electricity. Boulder power was not, of course, transmitted all that distance. Power from the dam was used simply to satisfy the needs of an adjacent area, allowing the area's normal source of power to feed its electricity into the next adjacent area, and so on up the line to Idaho.

Interconnection, too, makes it possible to



ship fuel oil, coal, or natural gas by transmission lines instead of by rail. This is accomplished by substitution, explains N. B. Hinson, executive engineer of the Southern California Edison Company and chairman of the Pacific-Southwest Power Interchange Committee. It may be that a certain small power system needs 10 carloads of fuel oil per day to keep its steam plant operating, and this fuel oil may have to be hauled hundreds of miles by rail. Often the best way is to convert the oil or other fuel into electricity at some steam plant close to the fuel source, and deliver the energy by transmission line where it is needed.

Electricity is an indispensable servant of civilization and in spite of the many tasks it performs today its greatest utilization still lies in the future. Handling power in bigger amounts than ever before, the pow-



Fifty-cycle current goes in one end of this frequency changer and 60 cycle current comes out the other end
Southern California Edison Co. photo

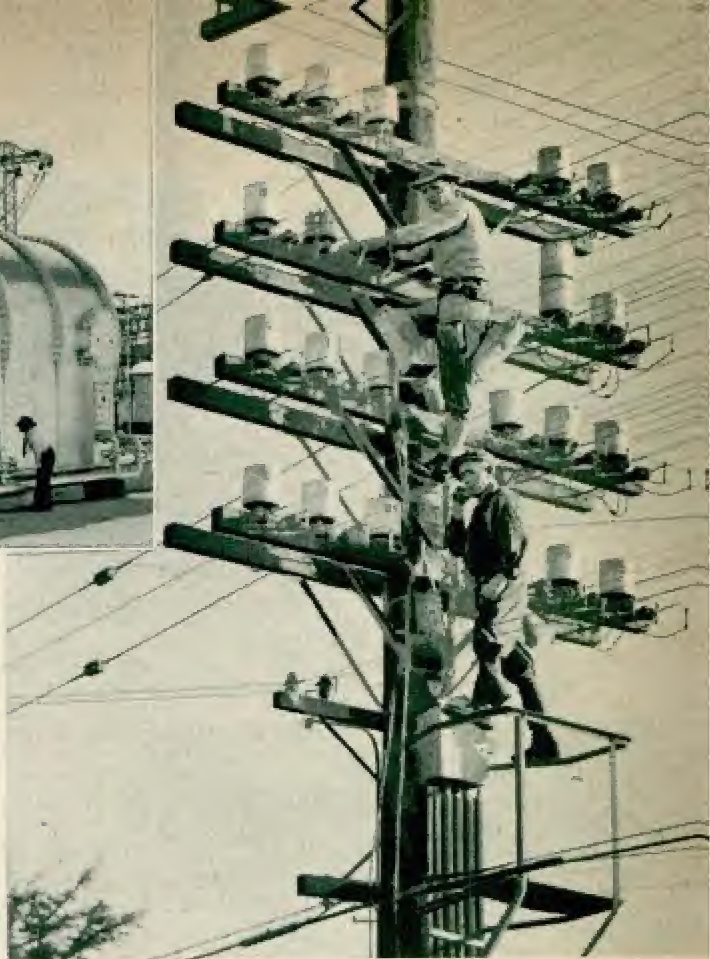
er industry is constantly overcoming new problems, putting electricity to new uses. One new use, electro-metallurgy, alone demands vast amounts of power.

Up in the Pacific Northwest, five aluminum refining plants that didn't exist three years ago are now producing more aluminum than was produced in the whole country five years ago. This is possible because of the electrical output of Bonneville and Grand Coulee dams on the Columbia River. Power from Grand Coulee alone would light three 60-watt bulbs in every home in the United States. Even so, installation of the turbo-generators that will make Grand Coulee the world's greatest powerhouse has not yet been completed. That title is still held by the generators at Boulder Dam.

When Boulder was built, no one dreamed that one industrial plant alone would shortly consume one fourth of its tremendous output of electricity. Yet that is the demand of Basic Magnesium, Inc., which uses more electricity than do half a dozen of the most sparsely settled western states together. Inside the plant buildings, many parts of the electrical system have been air conditioned so that the heavy power loads can be carried safely in spite of high summer temperatures. Air conditioning created its own problems, for the moisture in conditioned air combines with chlorine that is used in the plant process and causes corrosion, even on the surfaces of the huge silver and copper bus bars used as conductors. Exposed portions of the electric system must be kept painted.

Not long after BMI went into operation, mysterious flash-overs started in an outdoor 230,000-volt switchrack. Big bluish arcs flamed down over the insulators to ground. Then the circuit breakers kicked open. The cause was a film of dust from the magnesium operations settling on the

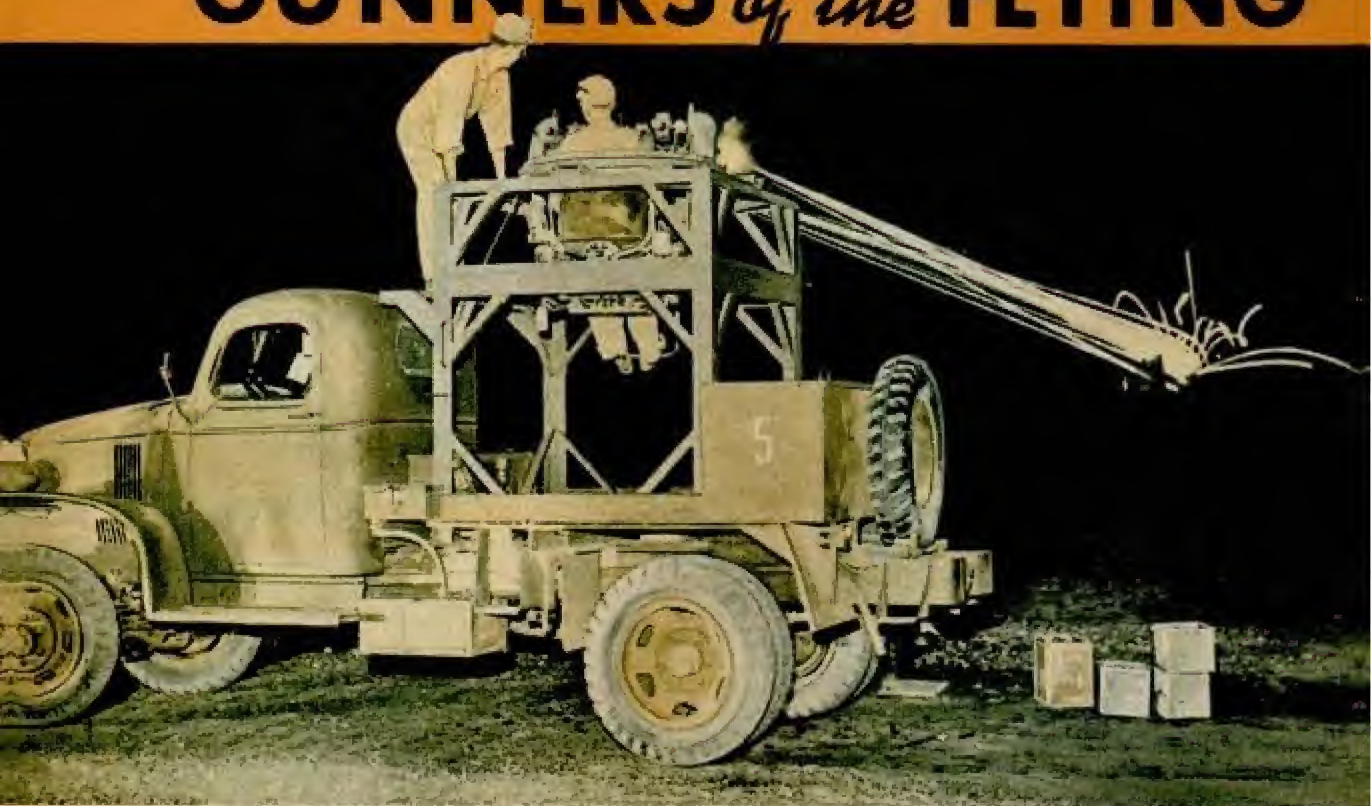
Continued to page 154



Linemen checking capacitors and protective equipment by which the high voltage transmission lines can carry telephone conversations. Below, a 100-ton copper and steel rotor for a new 7,000 horsepower electric motor. The rotor will be used to turn out steel plate for war



GUNNERS *of the* FLYING



Gunnery students on a mobile training turret fire tracer bullets in "night school." Below, waist gunner in a B-17, wearing high-altitude clothes, fires a belt of 50's



THE SHARP-EYED tail gunner in the last plane of the formation blinked.

"Tail gunner to pilot," he reported over the interphone, "There are a couple of B-17s overhauling us."

"Thanks sergeant," the pilot replied. "Keep your guns on them. None of our ships is missing so these may be two the Jerries captured."

Sneaking captured airplanes into a formation of our bombers is one of the stunts the Germans have tried in their efforts to hamper our raiders. Nothing they have tried so far has had much effect on our B-17s and B-24s, one reason being that our big bombers are flying porcupines, each of them defended by a dozen or more .50 caliber machine guns.

The gunners are picked men, able to recognize enemy aircraft at a distance and to knock them out with a few short bursts. No matter what position a man fires from, whether he is one of the small gunners in an electrically heated suit who squeezes into the ball or tail turret, or whether he manhandles a kicking machine gun in a side window, he has been taught not to waste ammunition. A good gunner fires eight or ten rounds in a burst, then another burst if needed. Long bursts may burn out

PORCUPINES

Mr. Stinson,
a barrel. Too, there is enough ammunition on board to operate all guns for only one minute of firing.

Aerial gunnery is the most complicated type of ballistics. The paths of bullets fired from a moving plane are affected by the plane's motion in ways that are puzzling until the reasons are understood. In some cases a gunner must lead his target by a considerable amount because of the target plane's forward motion in relation to the gun. In others, a gunner must aim behind an attacking airplane, since his bullets in addition to their movement away from the gun have a sideways motion acquired from the plane's own velocity. A bullet fired broadside from the



A 50-caliber gunner in oxygen mask deals a hand to enemy fighters

This armored turret with bulletproof window protects a Liberator's tail

Crew of a new B-17-G looks over the two-gun chin turret of Fortress



left of an airplane climbs slightly in the air while a bullet fired from the right side tends to drop. This phenomenon results from the friction, or lack of it, between the bullet's spin and the sideways resistance of the air. The gunner must allow for the curved trajectory of his bullet, the path of which is different at high altitude than it is closer to the ground.

To learn to compensate for



good gunner hates to leave his weapon even if his plane has been disabled and is being abandoned. There is one story about a bomber that was blown in two by anti-aircraft at 26,000 feet. Miraculously, the tail gunner wasn't hurt and since the broad tail surfaces allowed the tail to swoop earthward in a series of long glides, the gunner stuck at his post for 10,000 feet and shot down an FW-190 before he took to his parachute.

Some of the guns are mounted singly and aimed manually. Most of them, how-

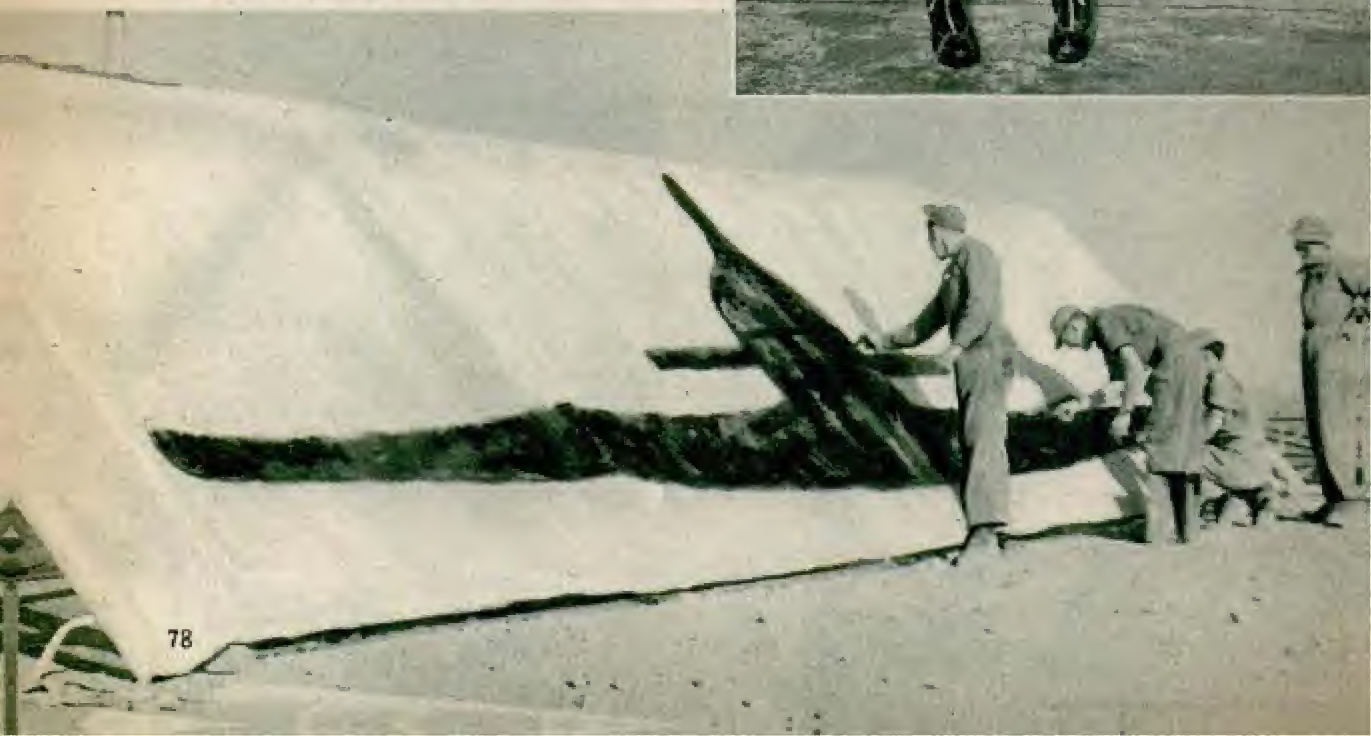
Radio operator of Flying Fortress in electric-heated suit mans top turret gun. Below, escape hatch in nose



these variables, gunners shoot skeet from moving trucks, shoot at clay pigeons with shotguns mounted on turrets, and fire at moving targets on the ground. On a motion picture range they simulate firing at aircraft on a three-dimensional screen. They are taken up in bombers to fire at towed targets. They use camera guns against a fast airplane that makes pass after pass at them from all angles.

Some of their instructors have had thrilling escapes from death in combat. A

Ground crew at gunnery school prepares a target representing enemy fighter diving toward bomber





ever, are mounted in pairs in turrets in the nose, tail, roof and floor. Electric motors turn the turret guns in response to the hand control grips. The 2½-inch curved glass of some turrets bends the light so that a target airplane appears to be where it isn't. Sights and guns are aligned to compensate for this.

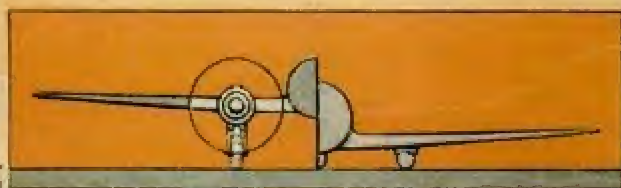
To take most of the guesswork out of aiming, turret gunners now have the Sperry computing sight, a mechanical sharpshooter that points their guns for them. Similar to the automatic predictor used by anti-aircraft gunners, the sight is mounted between the guns, equipped with an improved sighting eyepiece. As soon as the gunner recognizes the type of enemy plane, he sets the sight for the size of the target. Then he moves his controls to track the airplane on its course. This automatically gives the mechanism the information it needs to register the target's speed and course, allowing the mechanism to turn the guns toward that point in space at which hits will occur when the gunner presses his triggers.

The trend is toward more guns per bomber, to bolster a bomber's fire power in directions now least defended as well as to assist the other guns in beating off attacks concentrated in one direction. This in turn is leading to automatic guns aimed and fired by remote control, such as the new chin turret on Flying Fortresses.

(Top) Five projectors throw three-dimensional movie of enemy planes on screen for gunners to shoot at. Below, gunner attaches "walk-around" oxygen bottle



JET PLANE *of the* FUTURE



Reprinted from "Gas Turbines and Jet Propulsion for Aircraft" published by Aerosphere, Inc., New York City

Inset shows how propellerless ship hugs ground compared with other craft that needs greater clearance

If you blow up a toy balloon and let it go, the air rushing out of the neck sends it into a dizzy spiral. This is jet propulsion. The same theory is now hurtling propellerless fighter craft through the air at great heights and with potential speeds in excess of 500 miles an hour. There are two forms of jet propulsion. One operates on the rocket principle with a unit containing a combustible mixture which is independent of the atmosphere; the other, known as the thermal jet system, combines compressed air with fuel for combustion. In either case, gases escaping by a nozzle form the propulsive jet. The jet-propelled fighter planes now in production in the U. S. and England use the thermal jet system. Air is

sucked into a compressor and then passed through a pipe to the combustion chamber where it is mixed with gasoline. The mixture is ignited and the hot gases create great pressure. As the gases rush out to cause the forward thrust, they pass through a turbine which drives the compressor. The nozzle from which the gases escape can be moved to help maneuver the plane. As the ship speeds through the air it makes a noise like a giant whistling kettle—its only distinctive characteristic from the ground. Reduced density of the air at high altitudes is said to have little effect on a jet plane's performance. Engineers believe the simple construction of the power unit, reduced weight and greater driving force, have opened a new chapter in aeronautics.

Army Jeep Drives a Buzz Saw With Belt From Front Wheel

Living up to its reputation in the Army that "there's nothing a jeep can't do," one of the sturdy little cars was used recently to operate a buzz saw on the Italian front. The front end of the jeep was jacked up and a belt placed around a front wheel to provide the power. A sizable pile of wood was sawed for a field hospital in a jiffy with a minimum of "G. I." backaches.

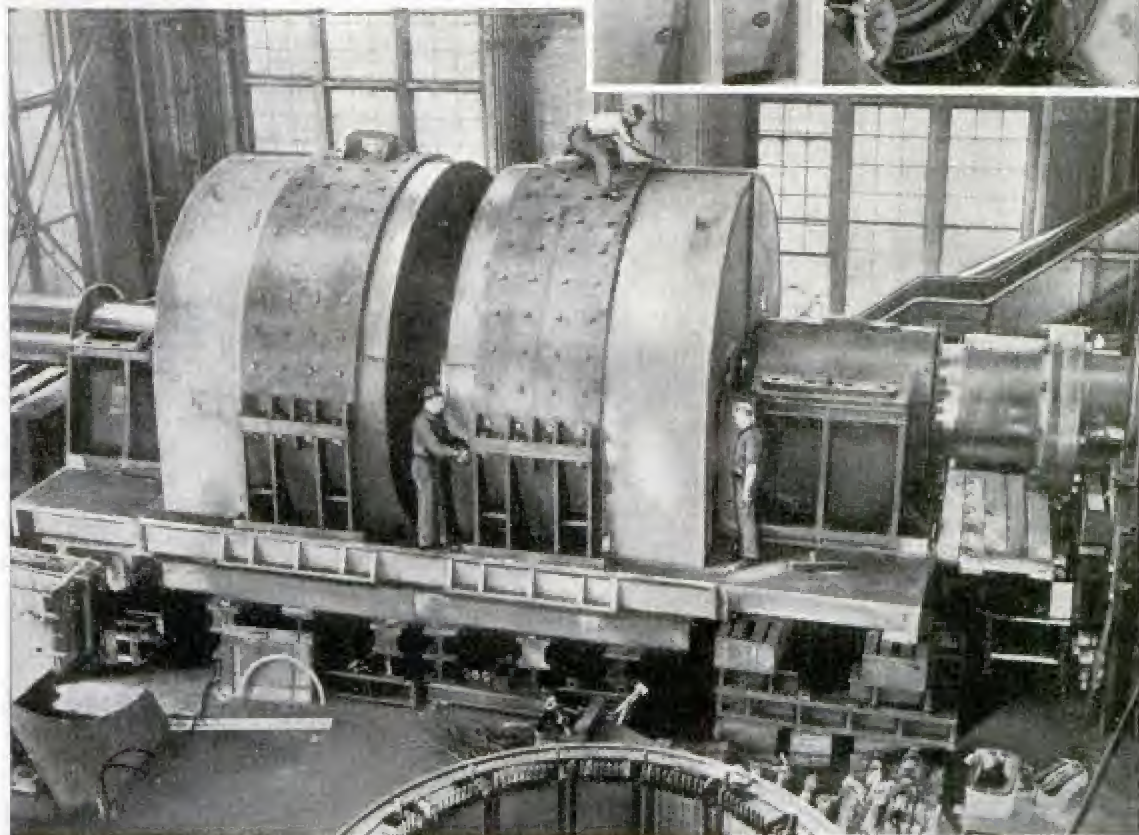
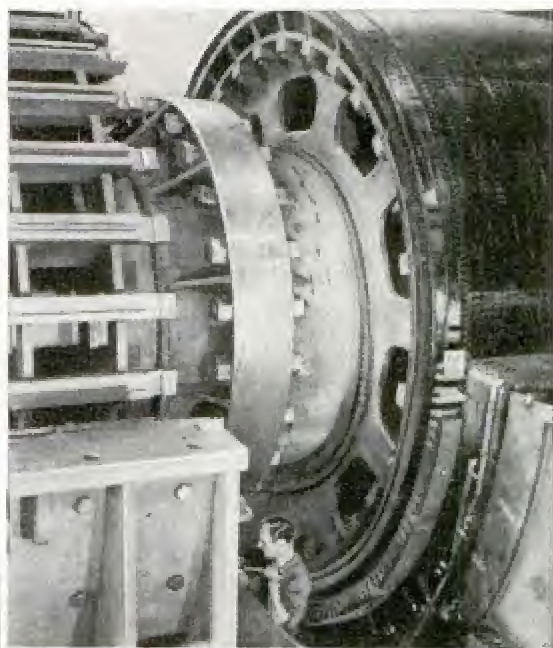
¶ Synthetic violet perfume is available today, but a few years ago it required 25 tons of violets to make one ounce of natural oil.



Million-Pound Motor Could Hoist a Destroyer

27 4/5
Built to roll ten-ton slabs of steel 200 feet long for shipyards and war plants along the Pacific coast, a million-pound electric motor built by the General Electric Co. at Schenectady is described as the most powerful ever constructed. When its 7,000 horsepower is applied at 25 revolutions per minute the motor will deliver more power, alternating or direct current, than any motor ever built. Engineers say that, theoretically, it could lift a 1,350-ton destroyer 200 feet high in a minute. It will operate a reversing rougher of a Utah steel plate mill, which will roll six- to eight-inch slabs of steel 60 inches wide into plates 127 inches wide and $\frac{1}{4}$ to $\frac{3}{4}$ inch thick. Quarter inch plate would weigh about 20,000 pounds.

Right, assembling the 7,000-horsepower motor. Below, twin-unit power package for a Utah steel plant



built for Plant of General Steel Co.
General, Utah

Dive Bomber Uses Propeller as "Air Brake" by Reversing the Pitch

Dive bombers can be slowed down more effectively by reversing the propeller pitch than by using flaps, reports Col. H. H. McCoy, chief of the Army Air Force Materiel Command propeller laboratory at Wright Field, O. Reversing the pitch converts the propeller into an air brake quite as efficient as the best wheel brakes for retarding ground roll in aircraft. Colonel

McCoy recommended reversing the pitch especially in fast-landing, nose-wheel, military aircraft on icy, wet or muddy landing strips. Commercial aircraft, he predicted, likewise will find reverse pitch braking of great value. He added that wheel brakes will continue to be used because they are most effective at low speeds and are needed for taxiing.

256

*"Mr. Stenson, Jr.
3872 Franklin Ave., Los Angeles 27, Calif."*

"YOU MARCH, YOU MARCH,"



← Wooden model of machine gun is used to train infantry

WHO is the most important man in the Army? There's only one answer to that. It's the common, ordinary infantryman, the soldier who fights on foot.

The infantry has been called the "Queen of Battles" for it is the infantry that decides a victory, captures the enemy, and occupies his territory. All the other arms including tanks and aircraft simply aid and support the infantryman in his job.

The foot soldier is the man who does most of the work and usually gets least of the credit. He's the man in the wet muddy uniform who sticks it out behind his gun, eating emergency rations out of a can. He's the one who faces machine gun slugs, who gets knocked around by high explosive shells, and who gets blown up by land mines. Tanks charge him, aircraft bomb him, and flame throwers and gas shells were devised to kill him. He gets the works, and keeps going.

In the last war Pershing asked for men who could "salute, march, and shoot," specifying in three words the ideal soldier who has been trained to carry out orders, has the endurance for



Foot soldiers cross unnavigable river on bridge made of rope

YOU MARCH"

Closeup of soldier practicing bayonet charge. Today's infantryman also can wield an array of small arms

marches and combat, and the marksmanship that leads to victory.

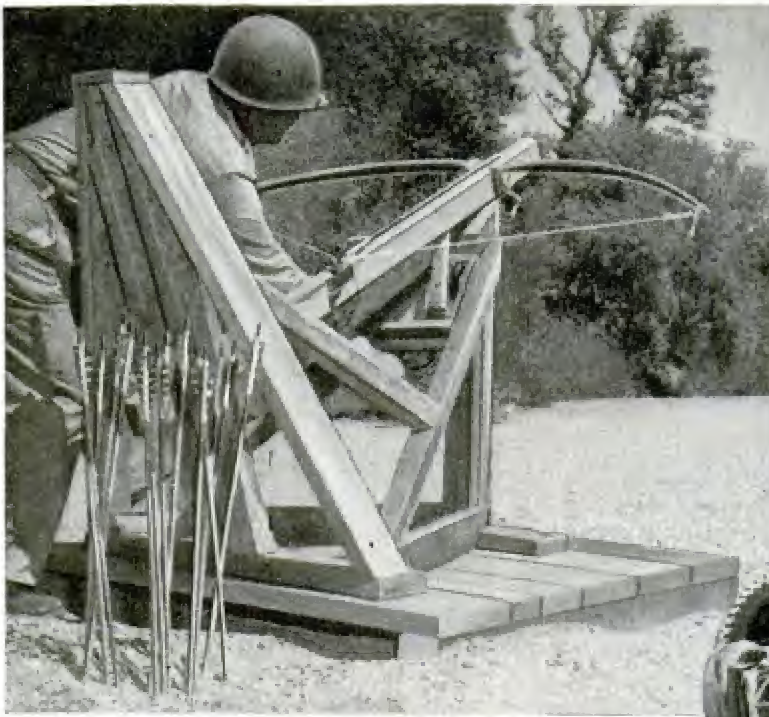
The American Soldier, Model 1944, is all that and more. He was an experienced trooper before he got into combat. He had learned how to camouflage himself and take advantage of cover. He had learned to shoot straight at still, moving, and flying targets. He had been taught by lectures and demonstrations and motion pictures the thousand and one things a soldier has to know, how to guard against land mines, how to build barbed wire barricades, how to protect himself from gas, and the mechanics of his weapons and equipment. He had been fed scientifically balanced meals and he was in the best physical condition of his life. He had learned the necessity of sticking by his mates,



Board shows duties of each man in extended drill. Left, pole climbing and rigging are taught linemen

the value of teamwork, and the importance of carrying out the orders passed down to him. He had even been indoctrinated into battle itself by means of infiltration and combat training in which machine gun and snipers' bullets came close to hitting him and land mines blew up nearby.

He has to know a lot more than any soldier ever had to know before. To the basic infantry weapons of rifle, bayonet, and hand grenade have been added a whole arsenal of specialized arms. The man in the ranks is familiar with them all and is an expert with several.



One of the hundreds of things foot soldier must be familiar with is the mathematics of trajectory, demonstrated here by arrows shot from a ballista machine

In the average infantry regiment you will find the following: pistols, semi-automatic carbines, Garand and Springfield rifles, Browning automatic rifles, bayonets, various types of hand and rifle grenades including antitank grenades, land mines, rocket-throwing bazooka guns, .30 and .50 caliber air- and water-cooled machine guns mounted for both air and ground targets, 60 mm. and 81 mm. mortars that can



toss shells over hills and into gullies, 37 mm. and 57 mm. antitank guns, and even 105 mm. howitzers.

Light artillery as part of the regular infantry was unheard of a few years ago but so were a lot of other weapons that the infantry now uses. The new cannon companies that are equipped with the howitzers operate in direct support of the other companies.

The bulk of infantry consists of rifle companies. In each such com-



pany there are machine guns and mortars as well as the standard infantryman's weapons of rifle and bayonet. Heavier machine guns and mortars are handled by special heavy weapons companies. The antitank companies use the new big rapid-fire guns against tanks and vehicles. Anti-aircraft guns are scattered all through each infantry organization. In fact, all available guns including rifles are used to pour a mass of fire against any low-flying enemy aircraft.

Included in the infantry are Pioneer outfits that have the job of reducing obstacles, clearing away booby traps, and building temporary bridges. Service companies provide transportation for the foot soldiers and take care of their supplies. Headquarters companies that handle wire and radio communication, intelligence, and staff work, and band detachments that act as stretcher bear-

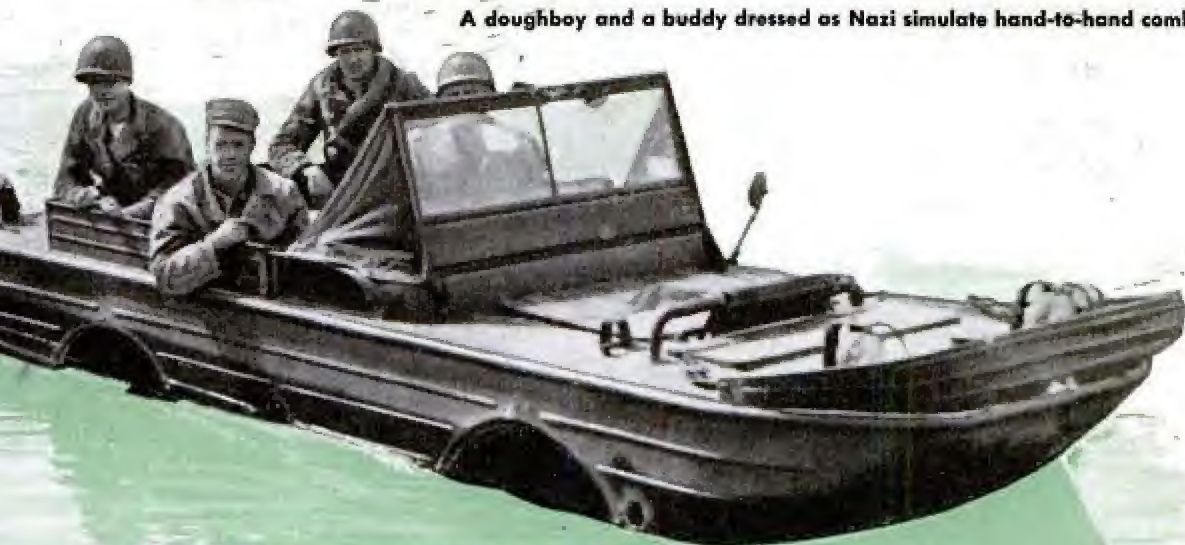
Terrain model helps explain contour lines on map in background

ers for the medical detachment in the field, are also parts of an infantry organization.

Battles are no longer fought by "armies" or by as many regiments of men as are available. All parts of the army are on a flexible basis and when a commander has the job of preparing for a campaign or making an assault against a particular target he makes up his plans on a task force basis. A certain amount of artillery, so many tanks, so much air support or protection, and so many infantry rifle com-



A doughboy and a buddy dressed as Nazi simulate hand-to-hand combat



Amphibious truck tows jeep that floats while tarpaulins keep it watertight. Left, sniper in camouflage uniform has hands and face painted in stripes



panies together with their supporting organizations are drawn from whatever organizations are handy. In the field all the units will work in co-ordination. In support of the fighting groups there must be a smoothly working team that moves them to the scene of action, feeds them and supplies them with ammunition, and cares for the casualties. Facilities to take care of prisoners that may be captured and even a staff to administer military government in the areas that will be won are all arranged ahead of time.

One of the things typical of American fighting men in all branches of the service is their resourcefulness. A truck driver may devise a new front end hitch for his truck, for pulling a stalled gun out of the mud. A machine gunner may work out a



Lowering jeep down cliff. Below, tin can prevents jeep's rear-view mirror from flashing up in air



Electric lights on terrain model, operated from push-button switchboard, explain where mortar missiles land

simple method for yanking a hot barrel out of a machine gun so that it can be replaced with a spare in a few seconds. Sometimes the designs of weapons at the factories are changed to take advantage of such battle-tried improvements.

Yankee ingenuity extends to the way he fights, too. If one kind of weapon won't do a job he hunts around until he finds one that will. One classic example occurred during the fight for Guadalcanal. At one point the Japs seemed to be impregnable. Ground troops that tried to advance against them ran into murderous fire at the crest of a ridge. The jungle was so thick that mortars couldn't do their job of wiping out the Japs. The Air Forces tried with bombs, but the thick matted growth slowed down and stopped the bomb

fragments. Then someone had a bright idea. The planes went up again, this time with naval depth charges in their bomb bays. After these were dropped on the enemy the ground forces advanced with hardly any opposition. The terrific concussion of the depth charges had done what bombs had failed to do, reaching out through the jungle and killing all the Japs within reach.

Army officers have made the boast that America's armies are the best trained, best equipped, and best cared for of all the armies in the world. There's one important point to add to that: Our soldiers, sailors, and marines fight with the spirit and enthusiasm of a winning team. And the infantry will win the last battle.



Jeep's "Stepchild" Has Icebox Motor Under the Hood

Half-sized copy of the Army's famous all purpose motorized gadabout, the jeep, is the "jeep's stepchild," constructed by a Chicagoan for his son. A careful copy of the original jeep, the "step-child" gets its power from a refrigerator motor.

A Wac and a lucky young man compare notes on the four jeeps. Four? Look on the hood of the toy car for two practice models

Frank W. Willerton
5024 S. Morgan St.
Chicago, Ill.

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Health 'Lighthouse' Peps Up Workers In War Plants

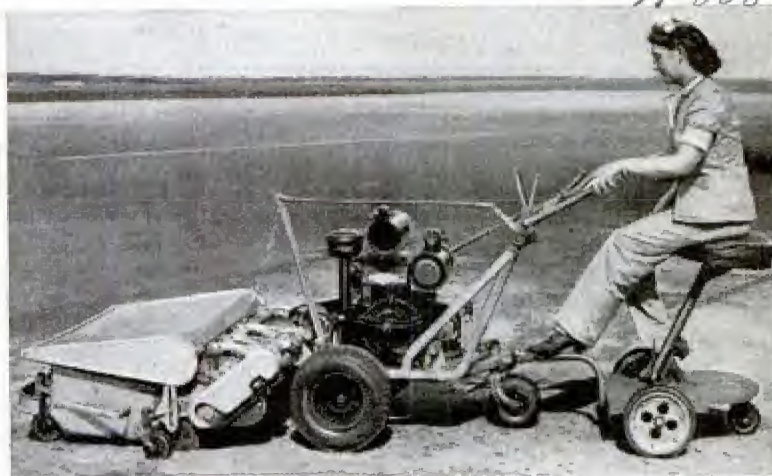
Ultraviolet Vitamin D rays may literally be shot at men or women standing in a circle around a miniature "lighthouse," developed for mass use and employed by Navy crews working below decks, and by workers in war plants. Standing in a ring five feet from the lighthouse, 15 persons may be bathed with ultraviolet within a few minutes. Thus, hundreds may utilize the tonic rays every day.



Airport "Sweeper" Picks Up Nails Along Runway

Nails, bolts, and sharp pieces of metal that might injure airplane tires are picked up with a power sweeper that literally "sweeps up all outdoors." A similar sweeper is used on hangar floors. The outside sweeper, which can be operated by a woman, takes the place of a crew of three or four men.

Courtesy American Airlines

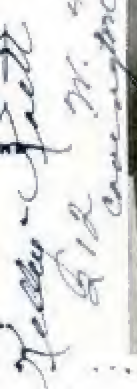


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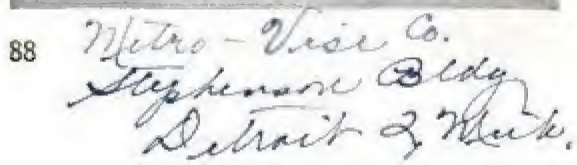
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The CRAFTSMAN

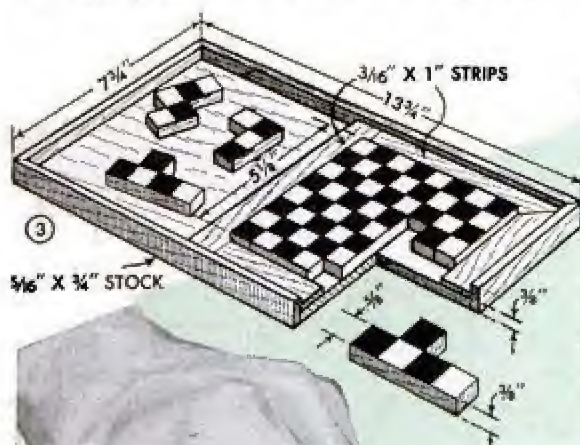
Three Wooden Puzzles

By Allan Carpenter

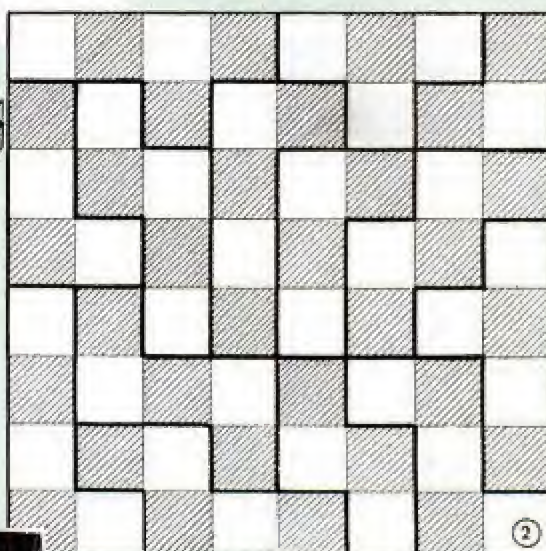
THESE puzzles are easy to make of scrap wood but difficult to solve. Base for the checkerboard puzzle shown in Figs. 1, 2, and 3, is a flat piece of wood to which are nailed 1-in. strips that enclose the playing space. Then side pieces are added, and the whole is stained and shellacked. The puzzle pieces are cut from hardwood or hard-pressed board to the shapes outlined by the heavy lines in Fig. 2, and black and white squares



①



③



②

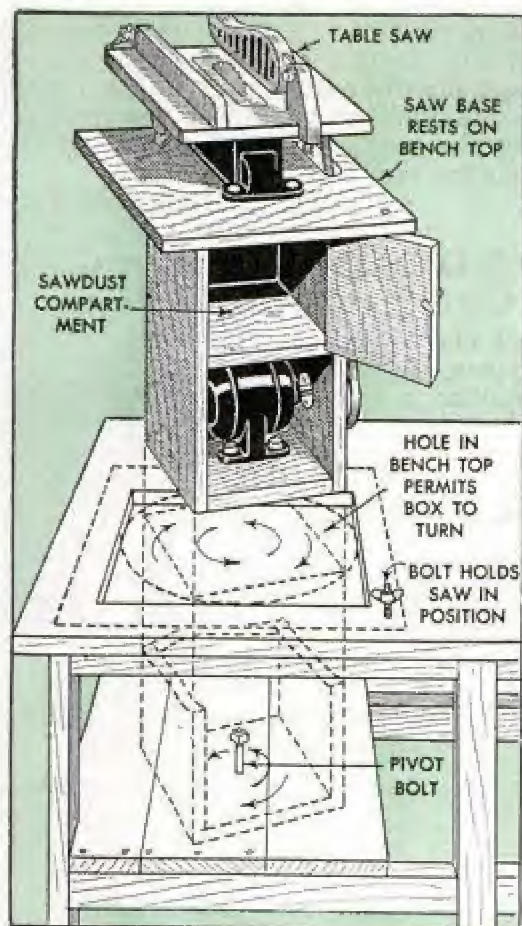


④

of equal size are painted on as shown. The object of this puzzle is to fit the pieces into the square to form a perfect checkerboard. There are many known solutions, one of which is shown in Fig. 2.

A wooden base 5 1/4 in. square to which side strips have been nailed provides a playing surface for the puzzle shown in Fig. 4. The fifteen disks are sliced from a wooden cylinder 1 1/4 in. in diameter, and the numerals from 1 through 15 may

Bench Saw Pivots for Ripping or Crosscutting



When limited space makes it necessary to use a circular bench saw close to a wall, here is a good way to pivot the saw so that it can be given a quarter turn to provide room for ripping or crosscutting long work. If the saw were attached permanently to a bench in a good position for ripping work, long boards could not be crosscut in their centers because of the short distance between the saw and wall. An opening is

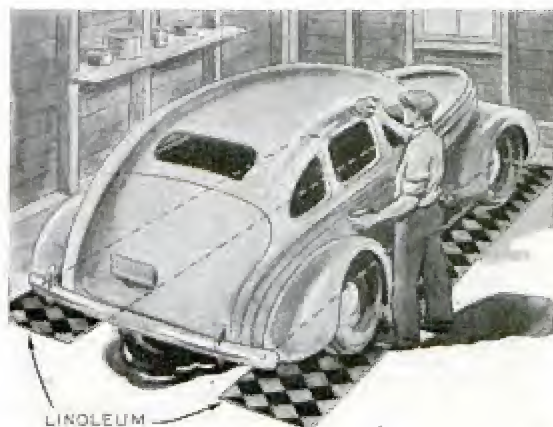
made in the bench top as shown to take the saw support, which is pivoted to a platform under the bench. Topped by a square base larger than the bench opening, the boxlike support is divided into two compartments, one for sawdust and one for the saw motor. A bolt in the bench top to engage holes in the saw base keeps the saw in the desired position.

—David Mort, Williamstown, Mass.

Protecting Tires Against Grease on Floor of Your Garage

Since grease quickly deteriorates rubber, every precaution should be taken to keep your tires from coming in contact with it, especially if there are oil and grease spots on your garage floor. One easy way of doing this is to use strips of old linoleum on the floor as shown. If a little oil or grease does get on the linoleum occasionally, it can be removed with a cloth dampened in gasoline.

❏Stitching holes left in material after a hem or seam has been ripped out will be less noticeable if you rake the point of a pin or needle across them in all directions.



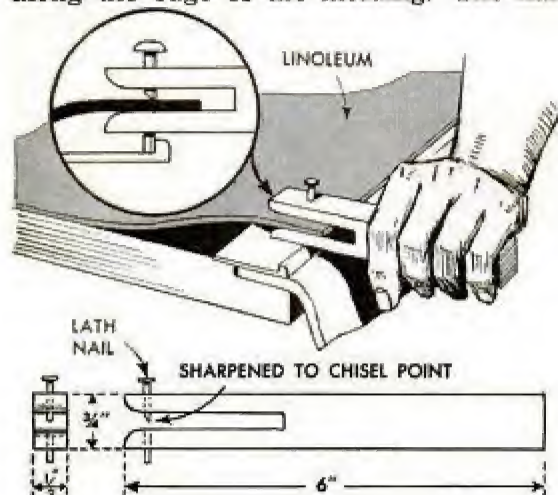
Oil-Soaked Corncobs on Pitchfork Make Torch to Kill Caterpillars



Corncobs soaked in oil and then impaled on the tines of a pitchfork provide a handy torch for destroying tree moths and caterpillars. The torch is inserted easily among the tree branches, burns a long time and costs nothing to renew as the oil used to soak the cobs is drained from autos or tractors. If a good pitchfork is used, care must be taken not to let the tines get hot enough to remove the temper from the metal.

Linoleum Marker Made on Job

Fitting linoleum closely around sink-rim moldings and other places can be done easily by using a simple marker made from a small block of wood and a nail. The block, about 6 in. long, is grooved at one end to a depth of 1 to 2 in. A lath nail then is driven through the block and the sharp end filed flat to permit it to slide easily along the edge of the molding. The nail



also is filed in half at the groove, and the upper half sharpened to a chisel edge as shown. After inserting the marker over the linoleum and against the guiding edge of the molding, the head of the nail is tapped slightly until the chisel edge cuts into the linoleum. Guiding the marker along the molding scores a line, which marks the linoleum for cutting.

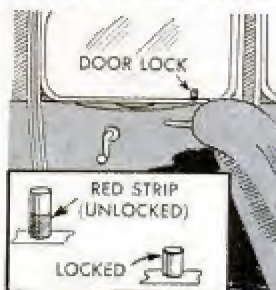
—Ray Ligocki, Hammond, Ind.

Cork Disks Provide Finger Grips On Sides of Glass Graduate

Accidental dropping of glass graduates is less likely to happen if cork disks are glued to the sides of the glass to provide good finger grips. Corks taken from bottle caps are ideal for this purpose.



Painting Knob on Door Latch To Tell When It Is Locked



Instead of testing the locks on your door every time you leave your car, paint a red stripe about half way down on the lock knob. In this way a glance at the knob will show whether or not the door is locked. If the red stripe is visible, of course, the door is not locked.

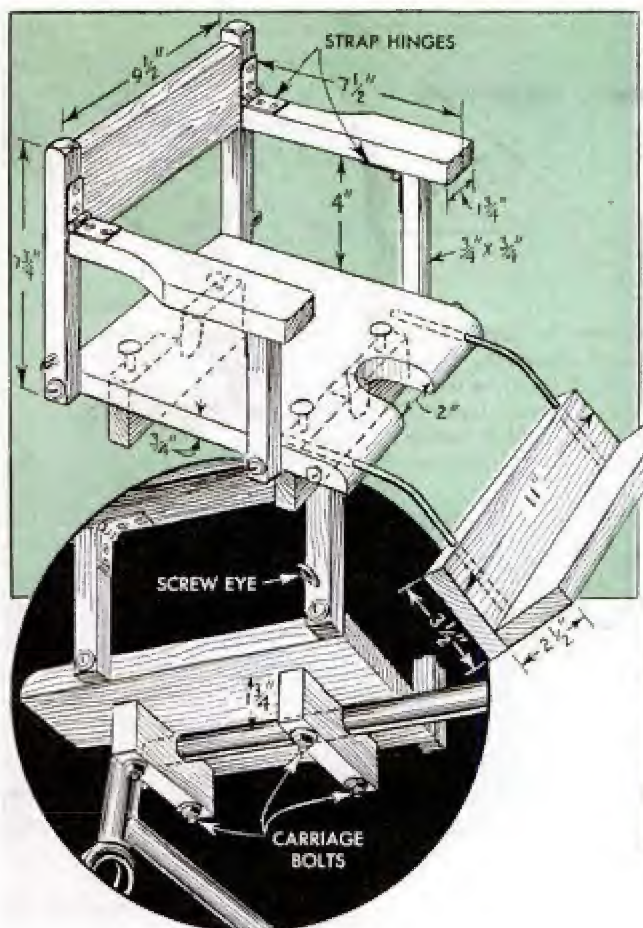
—Don McMillan, Thorold, Ontario, Can.

Finger Holes in Chopping Block For Easy Carrying

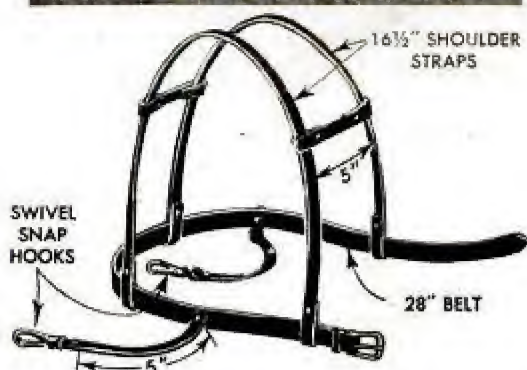
Rather than attach metal or wooden handles to your chopping block and risk having them broken in rough usage, simply bore finger holes in each side for carrying the block. Bore the holes just far enough from the upper edge of the block so that the thumbs will rest comfortably on the upper surface when carrying the block.



Auxiliary Seat Carries Small Child on a Bicycle



Suitable for a child from six months to three years of age, this seat is clamped to the cross bar of a man's bicycle and keeps the child in front of the rider where it can be watched easily. Any possibility of the child falling out is avoided by a harness, which fits around his body and is fastened to the seat. Although the detail of the seat shows the grain running at right angles to the clamping strips, the seat is less likely to split if the grain runs parallel to the clamping strips. Four pivoted uprights to support back and arm rests are fastened to the sides of the seat with large wood screws, the arm rests being hinged to all four supports as indicated. This permits the assembly to fold for easy storing. The steering post of the bicycle fits in a large



notch at the front of the seat. A foot rest is connected to the seat by two iron rods, secured by two setscrews driven into the edge of the seat at each side. The harness consists of strips of leather riveted together and is fitted with two snap hooks that engage screw eyes on the front uprights.

—William A. Landau, Chicago.

Novel Beads in Various Colors Are Made Easily From Candle Wax

Colored necklaces of wax beads are a popular novelty in some parts of the country. By holding a match to the end of a candle of the right color and allowing the melted wax droplets to fall on waxed paper, you can make oval wax beads of varying sizes, the size depending on how high

the candle is held away from the wax paper. The beads are strung by using a needle and thread, forcing the needle through them while they are still on the wax paper.

❏ Clamps from ice or roller skates make good emergency clamps for narrow work.

Solving HOME



Left: Applying liquid wax to floors with an insect spray is more thorough, more economical and less difficult than the usual method. Right: Cleaning the small holes in a food-chopper disk is simpler if a bobby pin bent as shown is used for the purpose

FOOD-CHOPPER DISK

BENT BOBBY PIN



CLOTHESPIN

Above: Dropping a slice or two of lemon in the lower section of a glass double boiler helps to prevent the formation of scale. Left: Spring clothespins clamped to the lower bar of a clothes hanger can be used to keep ladies' garments from sliding off. Right: After using rubber gloves, sprinkle the inside with cornstarch, and keep them in the refrigerator. This care will prolong the life of these gloves



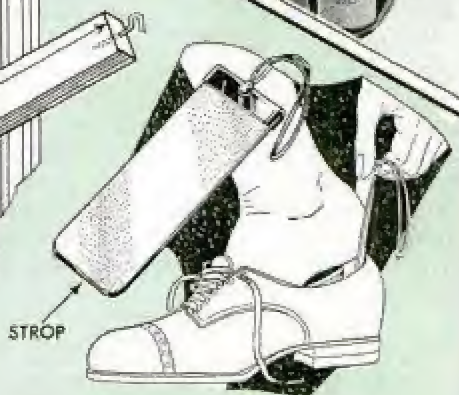
Left: If a small piece of gum camphor is placed in your silverware chest, it will be found effective in keeping the contents from tarnishing. However, the use of camphor is unnecessary if the chest is one of the "tarnish proof" variety

PROBLEMS

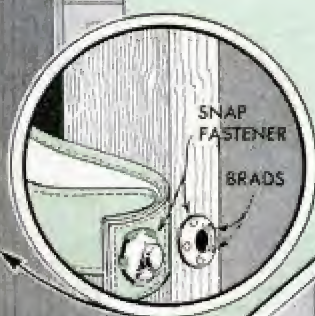


Above: A piece of ordinary mailing tube notched as shown makes a convenient and safe reel for an extension cord and bulb. Right: A 2-ft. length of $\frac{1}{4}$ -in. wood with hooks added at each end, holds a storm door partly open without the bother of a wedge at the bottom. Below: Attaching one half of a snap fastener to the edge of a window frame and sewing the other half to the curtain tieback is a permanent and handy method of holding curtains; the tiebacks can be snapped on and off for laundering without the bother of nails, pins or thumbtacks.

Supported on three pipes set in cement, a garbage can will not be upset by dogs, and it is kept from rusting by contact with the damp earth. Fittings anchor the buried ends and hold the can about 6 in. above the ground.



A razor strop that has become useless for its original purpose will serve as a shoehorn when cut to proper size.



Right: Long, heavy-wire hooks substituted for the short ones in children's garment hangers will make it easy for any child to reach high clothes poles without the necessity of climbing on a chair or disposing of the clothes in a careless or untidy manner.



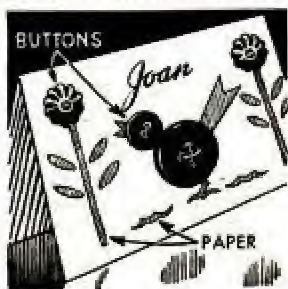
Spike Points in Slotted Sawhorse Hold Boards for Edge-Planing



A sawhorse that will hold short boards securely for edge planing is made easily as indicated. The two sides of the top pieces are spaced apart a distance equal to the thickness of a standard board, and a center member is provided with projecting spikes which keep the work from slipping under the plane.

Novel Button Place-Card Favor

Plain buttons for the perky little bird, fancy ones for the dainty flowers and a bit of construction paper are all you need to make these distinctive place-card favors. Buttons are sewed on for the body and head of the bird, and the flowers, using thread of a color that contrasts with the color of the buttons to simulate wings, eyes and flower centers.



Testing Your Starting Motor With a Safety-Razor Blade

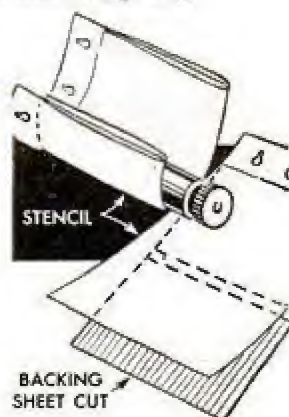


If the starting motor on your car lacks pep and seems draggy even though the battery is in good condition, it may be that the armature is rubbing on the field coils. To find out, take a

thin safety-razor blade and hold it lightly between the thumb and forefinger, resting the hand on the motor housing so that the blade can be held just off the housing. Then start the motor. If the armature is rubbing at any point, the blade will be attracted to the housing.

Folding Mimeograph Stencil For Accurate Typing

Typists who sometimes have to type a mimeograph stencil lengthwise to print a two or four-page folder, usually are handicapped because the typewriter carriage is too short to take the stencil without doubling it. This causes the thick backing sheet to form a bunglesome piece that may result in misaligned copy. The trouble can be avoided by cutting away the lower half of the backing sheet so that the stencil need be folded over but a single thickness. Then, if care is taken in folding and inserting the stencil, it can be typed with accurate register.

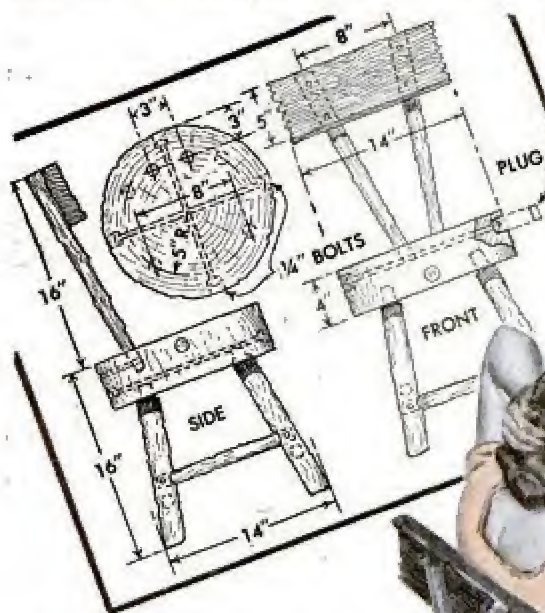


Spiral Tent Pegs Protect Lawn From Unsightly Holes

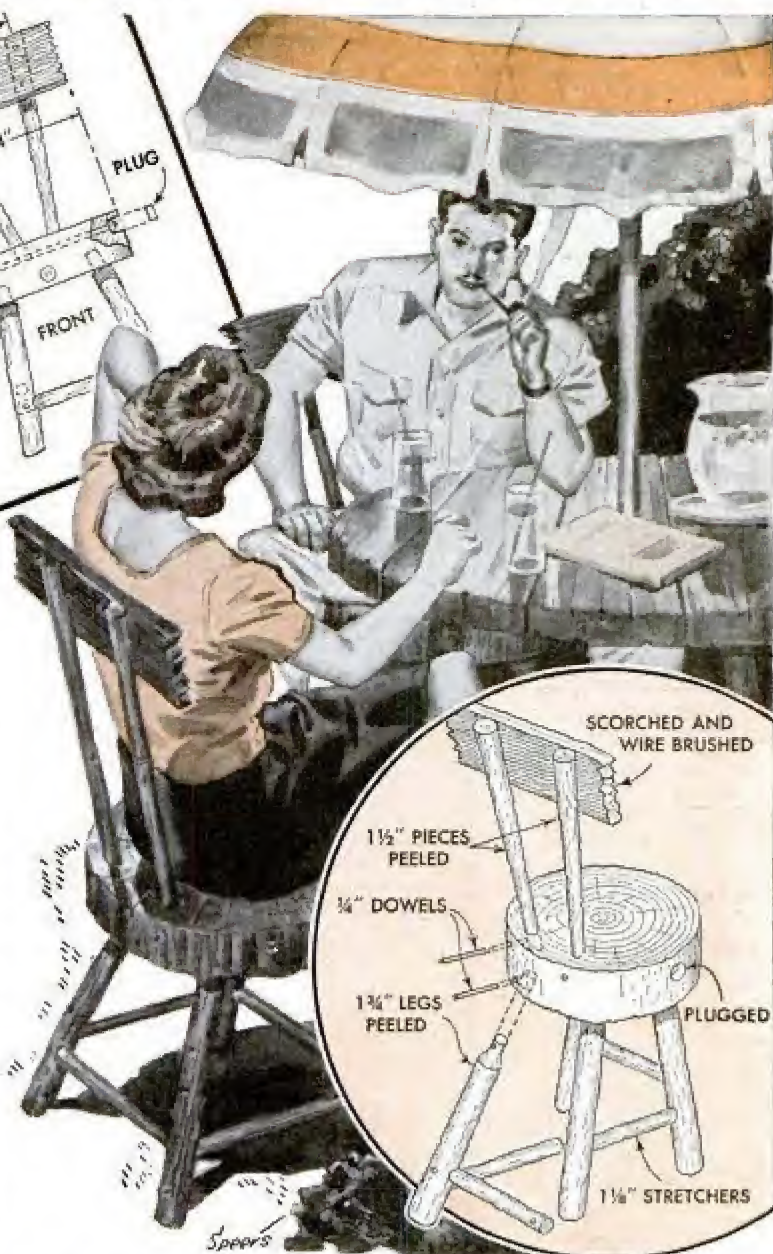
Disliking to have his lawn marked with tent-peg holes when his son found it necessary to "break camp" so frequently, one father conceived the idea of providing corkscrew pegs of heavy wire. These not only overcame the original difficulty but held much better in all kinds of weather.



Make Rustic Chairs for Your Garden or Lawn



Sturdy and weather-proof, this rustic chair is just the thing for a terrace or other outdoor use. Seasoned saplings provide legs, stretchers and back supports, while the seat is a section of log. All joints should fit snugly, and are strengthened with casein glue. To reinforce the legs and the back supports, dowels are driven into holes bored in the seat as shown. If a long bit or shipwright's auger is available, the seat should be reinforced with 1/4-in. bolts or with 3/8-in. dowels, glued in place. Plugging the openings of bolt holes will conceal the bolts. In case a suitable bit or auger is not available, an old bit can be welded to a steel rod and the end hammered to a tapered square for chucking. Scorching



some of the surfaces with a blowtorch and scratching them with a wire brush helps to produce a weathered appearance.

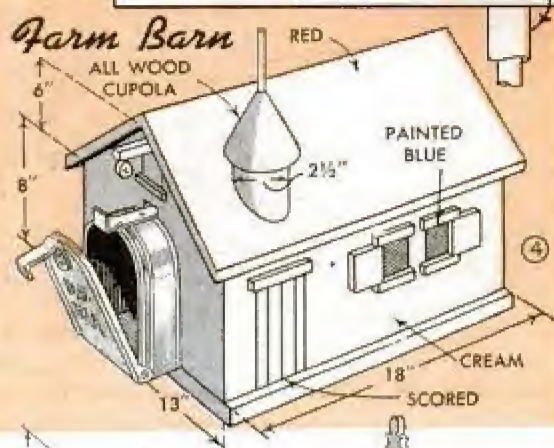
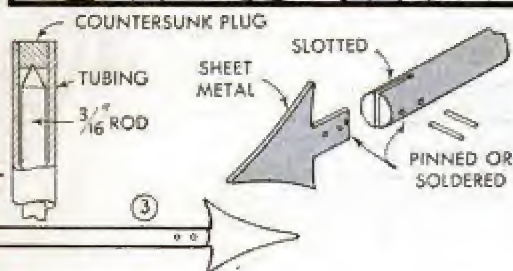
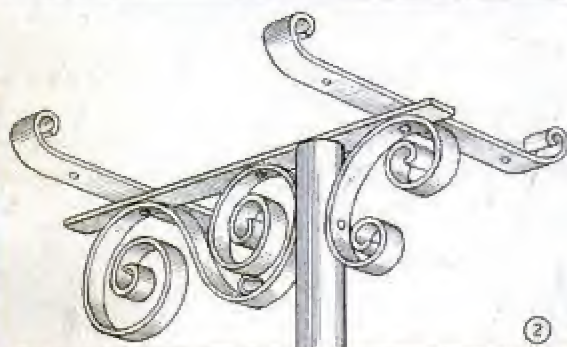
Laying Spectacles on Bows Will Protect Lenses From Grit Scratches



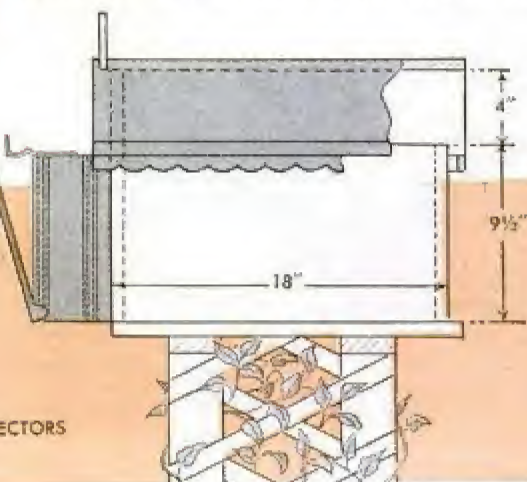
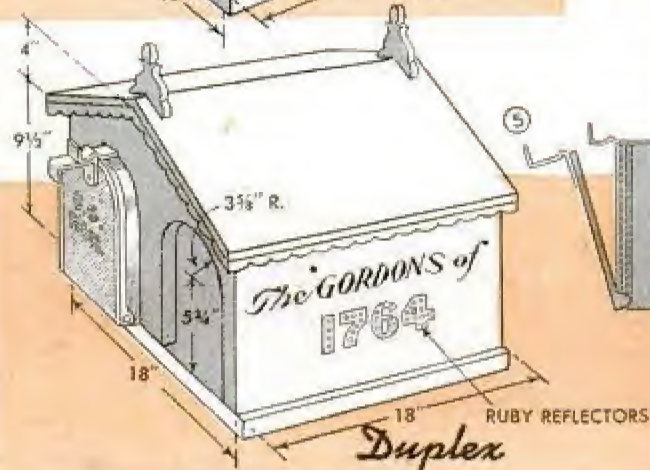
Although it is common practice for persons wearing spectacles to lay them down so that they rest on the lenses, this habit is often responsible for grit scratches that may be the cause of eye strain. Opticians always recommend that the glasses should rest on the bows.

☞ Rabbits will stay away from garden plants sprinkled with a combination of bitter allis, 1 oz. and rotenone 1 lb.

Housing the Rural



INSTEAD of mounting a plain metal R.F.D. mailbox on a post alongside the road or street, why not make it less conspicuous by housing it inside a miniature building mounted on a decorative support? If none of the housings suggested here harmonize with your home surroundings, copy one of your own buildings in miniature. All of the housings shown meet Post Office regulations and do not inconvenience the postman because the hinged ends of the regulation



MAILBOX



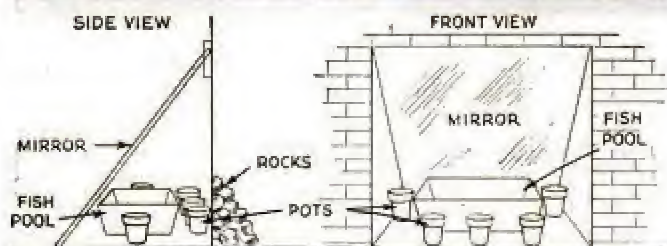
boxes project an inch or so. If you use a copy of one of your own buildings, be sure that the end of the mailbox projects and that no part of the housing interferes with the postman inserting the mail.

The farm barn pictured in Fig. 1 and detailed in Fig. 4 is ideal for some rural homes. Window sills and shutters are cut from $\frac{1}{8}$ -in. material and the dummy panes are painted blue. The door is scored to resemble planking. The scrollwork under the base of the housing is detailed in Fig. 2, and Fig. 3 shows how to make the weathervane. The duplex design in Fig. 5 is ideal for the cottage suburban home. It provides accommodation for papers, magazines and other bulky mail in addition to the standard box. The latter is screwed to the floor, and the little house is mounted on two posts braced with lattice work, which also serves as a trellis.

If you wish something more elaborate, the timbered house in Fig. 6 is attractive. The plain structure is built complete, after which the timber work is secured with brads, the walls having first been painted cream and the strips brown. Stonework around the entrance is simulated by painting white mortar lines on a gray background. For a shingled roof, make irregularly spaced saw cuts in beveled strips of wood. A neat panel carrying the house number and suspended on chains provides an effective touch.



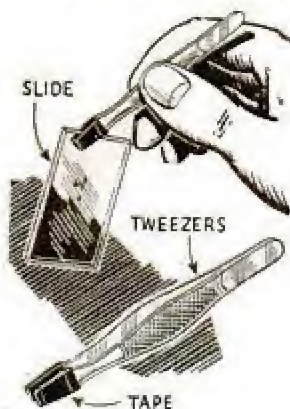
Rock Garden Built in Fireplace During Summer Months



One home owner beautifies his smoke-blackened fireplace during summer months by making a rock garden inside it. The same idea also can be used the year 'round in imitation fireplaces. Potted plants and a small fish pool, which can be any suitable container, are arranged as indicated in the lower details, after which decorative rocks are piled around the pots and fish pool to simulate a garden. A mirror placed at an angle at the rear reflects the garden image and gives an illusion of depth. Being at an angle, the mirror also enables the garden to be seen clearly from any place in the room.

—Nelson Edwards, Baltimore, Md.

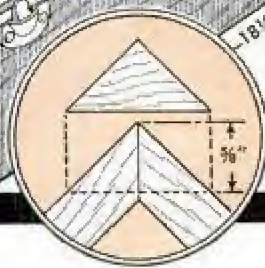
Microscope Slides Are Kept Clean If Handled With Taped Tweezers



By covering the ends of a pair of tweezers with adhesive or friction tape, you can use them to good advantage in handling microscope slides. The tape enables you to grip the slides securely, and you can manipulate them easily without touching them with the fingers; thus eliminating fingerprints. Users of projection slides will find similar advantages in handling them the same way.

You Will Be Proud Of This Bait Box

You'll never regret being unable to obtain a metal bait box if you make this fine wooden one, which also affords a very interesting wood-working project. The original box was made of $\frac{1}{2}$ -in. walnut, but any available hardwood will do. A careful study of the drawings will show you how the box is assembled. The upper and lower halves are identical in size and shape, the top of the box being rabbeted into the upper half and the bottom dadoed into the lower half. Notice in one of the lower left-hand details how the abutting edges, when the box is closed, are rabbeted on opposite edges to form an interlocking joint that excludes water and dirt. The box is put together with simple glued miter corners. When the glue has dried, the corners are slotted horizontally and reinforcing splines are glued in place, after which all corners and top edges are carefully rounded. Two five-compartment trays of $\frac{1}{4}$ -in. stock are made as shown and pivoted to the box with cantilever arms of hard maple. The attaching or pivoting pins are simply pieces of $\frac{1}{16}$ -in. dowel having narrow shoulders or heads turned on the ends as shown in one of the lower details. The pins are inserted through the levers and then glued into holes in the trays, the heads on the pins keeping the levers from slipping off. Hinges and snap locks taken from an old suitcase may be used on the box. A handle is jigsawed from matching wood and is attached by means of wire "hinges" as shown in the lower left-hand detail. After a careful and thorough sanding, the box is given a weatherproof finish by applying three coats of spar varnish inside and outside.



X205B

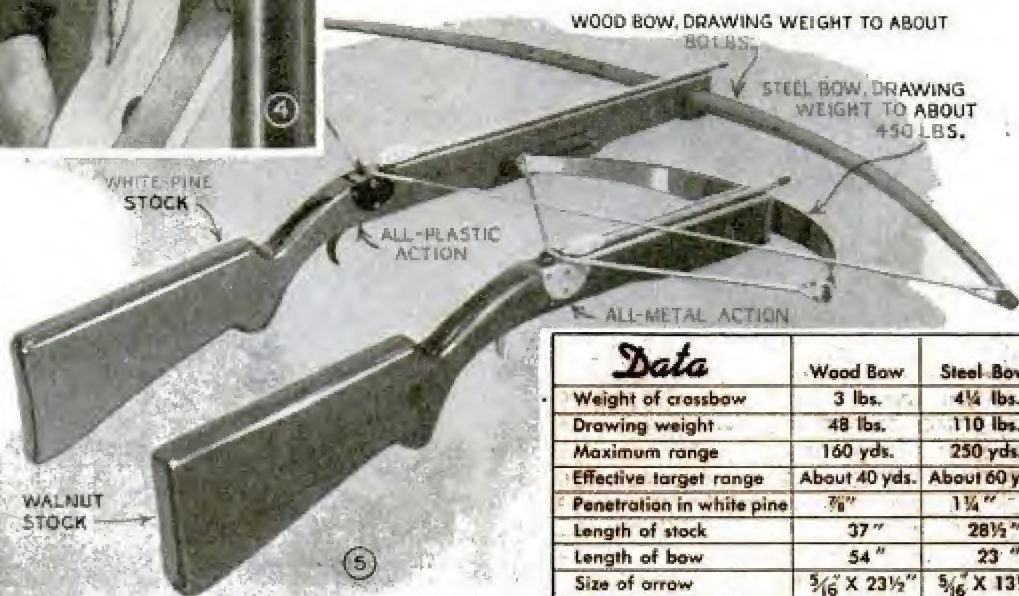


SHOOT THESE



IF YOU can't hit the bull's-eye with a regular archer's bow and arrow, try one of these modern crossbows and you'll find yourself hitting the "gold" almost every time from distances up to 60 yds. They are good for hunting, too; a 160-lb. steel bow will stop anything short of an elephant. Two models are described in this story, both very similar in construction except that one has a wood bow and the other a steel bow. Comparative data is given in table of Fig. 5.

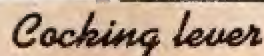
Stock for wood bow: The stock of the wood bow can be made from white pine. Its shape is very much like a modern rifle as can be seen in Fig. 8. Start the job by making a full-size drawing of the stock including the full detail at the trigger as shown in Fig. 9. Transfer the stock outline to 1 $\frac{1}{8}$ -in. white pine and saw it out. Drill the hole for the string release, using an expansive bit as in Fig. 2. Recesses on either side of the hole are run in with a straight shaper cutter, Fig. 3, the guide collar rubbing the hole. Lacking shaper equipment, the recesses can be cut with a router bit in a drill press. Fig. 4 shows the mortise for the



Data	Wood Bow	Steel-Bow
Weight of crossbow	3 lbs.	4 $\frac{1}{4}$ lbs.
Drawing weight	48 lbs.	110 lbs.
Maximum range	160 yds.	250 yds.
Effective target range	About 40 yds.	About 60 yds.
Penetration in white pine	$\frac{7}{8}$ "	1 $\frac{1}{4}$ "
Length of stock	37"	28 $\frac{1}{2}$ "
Length of bow	54"	23"
Size of arrow	$\frac{5}{16}$ " X 23 $\frac{1}{2}$ "	$\frac{5}{16}$ " X 13 $\frac{1}{2}$ "



All working parts of the action are made from plastic. Dimensions given will provide sufficient strength for bows up to 60 lbs. drawing weight. Over this weight, the release plates should be $\frac{3}{16}$ -in. plastic and the trigger should be made from $\frac{3}{16}$ -in. metal. After fitting the release plates, the top of the stock is sanded down to about the dotted line shown in



is required when bow pulls over 100 pounds. Bows that pull less than this weight can be set by hand



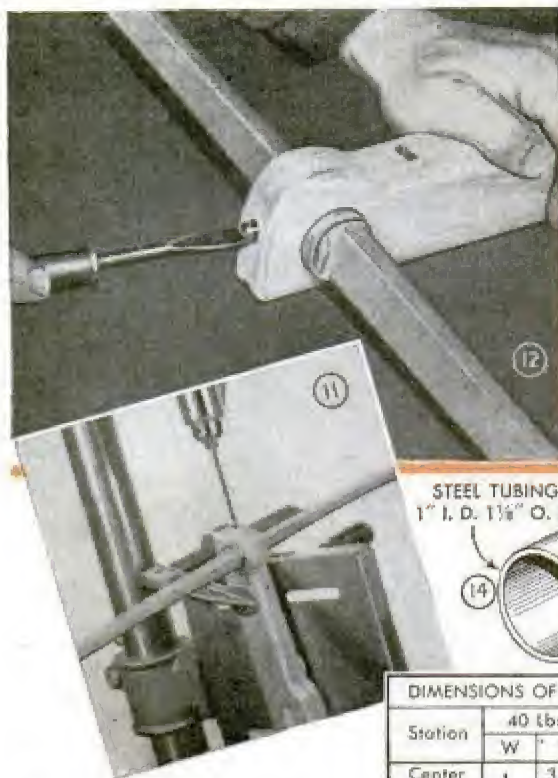
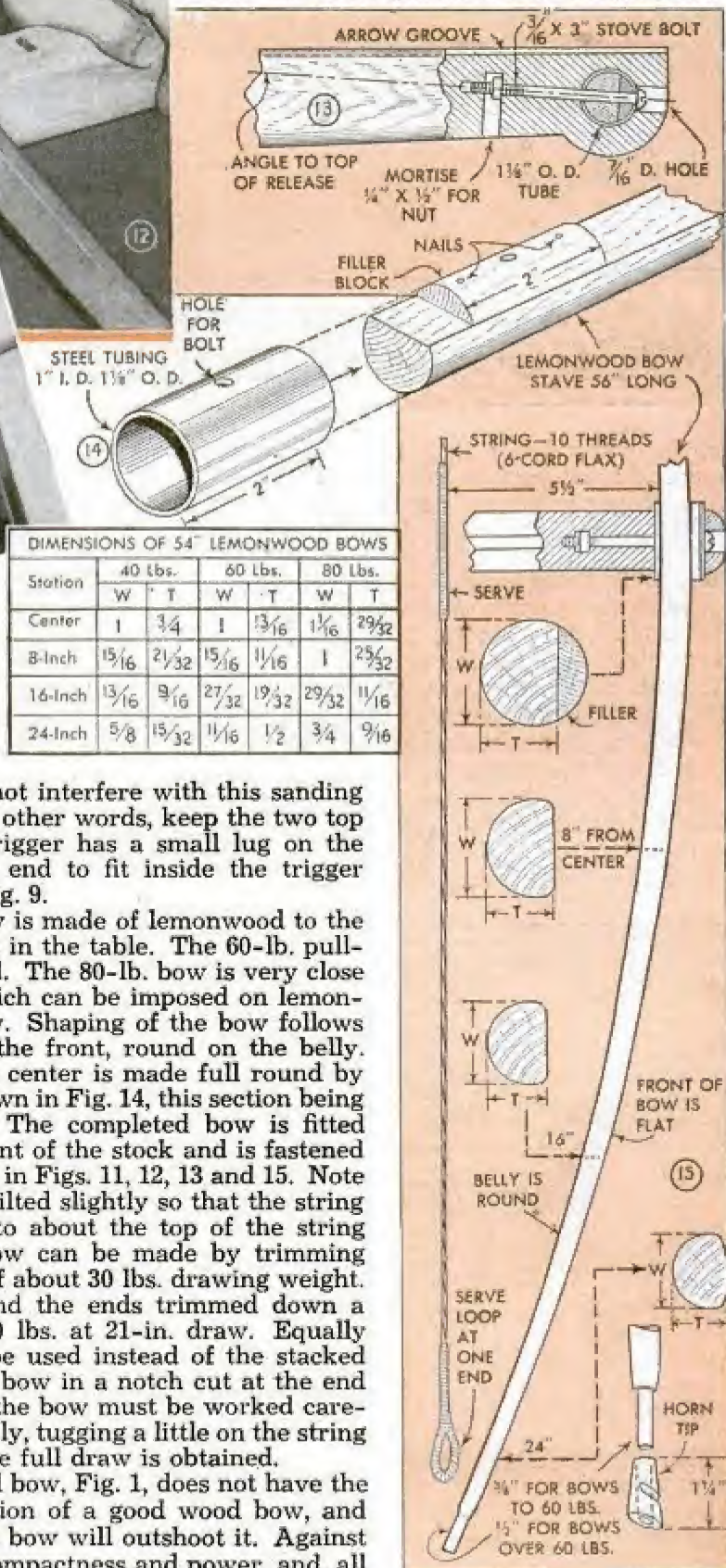


Fig. 9. Fig. 10 shows the operation. The sharp edges are then faired into the shaper cuts. Be careful in fitting the release plates so that screws will not interfere with this sanding and rounding operation, in other words, keep the two top screws low. The plastic trigger has a small lug on the underside near the upper end to fit inside the trigger spring, as can be seen in Fig. 9.

The wood bow: The bow is made of lemonwood to the approximate sections given in the table. The 60-lb. pulling weight is recommended. The 80-lb. bow is very close to the maximum stress which can be imposed on lemonwood in this length of bow. Shaping of the bow follows standard practice, flat on the front, round on the belly. A section 2 in. long at the center is made full round by adding a filler block, as shown in Fig. 14, this section being enclosed in a steel tube. The completed bow is fitted through the hole at the front of the stock and is fastened with a $\frac{3}{16}$ -in. bolt as shown in Figs. 11, 12, 13 and 15. Note in Fig. 13, that the bow is tilted slightly so that the string when pulled back comes to about the top of the string release. If desired, the bow can be made by trimming down a regular 6-ft. bow of about 30 lbs. drawing weight. When this is shortened and the ends trimmed down a little, it will pull about 60 lbs. at 21-in. draw. Equally practical, a flat bow can be used instead of the stacked type shown, mounting the bow in a notch cut at the end of the stock. In any case, the bow must be worked carefully and broken in gradually, tugging a little on the string and then releasing until the full draw is obtained.

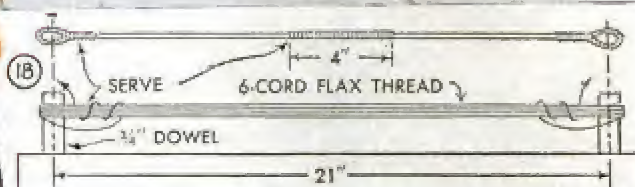
The steel bow: The steel bow, Fig. 1, does not have the silky, smooth shooting action of a good wood bow, and pound for pound the wood bow will outshoot it. Against this, the steel bow offers compactness and power, and, all

Wood bow is 54 inches long, made from lemonwood. Approximate section for 40, 60 and 80-lb. bows are given in table below. Bow is strengthened at center by steel sleeve





The steel bow is compact and powerful. Metal is obtained from a light automobile spring, which is sawed with high-speed steel hacksaw blade to the shape shown above



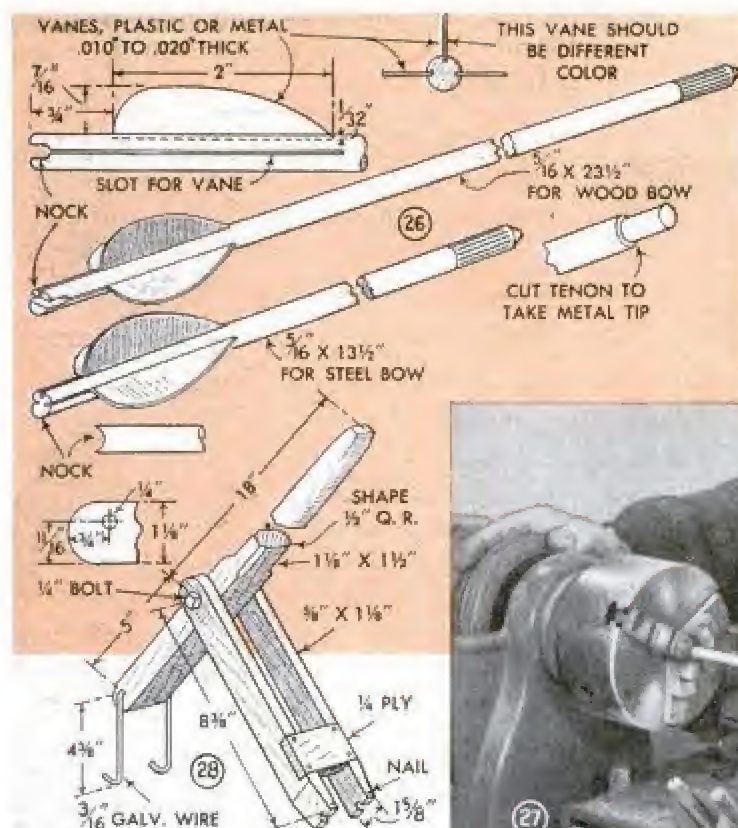
(20)		23-IN. SPRING-STEEL BOWS					
Spring Thickness	Initial Set	Brace	Spring to Release	Pull and Threads to Hold			
				1" Wide	1½" Wide	1½" Wide	
⅛"	About 2¼"	3½"	11½"	42 lbs./12	52 lbs./12	63 lbs./12	
9/64"	About 2¼"	3½"	11½"	60 lbs./12	75 lbs./16	90 lbs./18	
5/32"	About 2¼"	3½"	11½"	83 lbs./16	104 lbs./20	126 lbs./24	
3/16"	About 2¼"	3½"	11½"	142 lbs./28	179 lbs./36	216 lbs./42	
7/32"	About 2"	3"	10½"	188 lbs./39	236 lbs./48	285 lbs./56	
¼"	About 2"	3"	10½"	269 lbs./56	363 lbs./70	438 lbs./82	

things considered, makes much the better cross-bow. The spring stock can be obtained from a light automobile leaf spring. It will cost you two high-speed steel hacksaw blades to saw it to shape, Fig. 19. If the spring is a little wider than needed, it is a good idea to leave the extra metal intact at the center, as shown in Fig. 16. The bow tips are cut from sheet plastic, riveted in place and filed to take the string. The steel bow will have an initial fixed set of about 2-in. deflection, and should be braced at 3½-in. deflection as shown in Fig. 16. The table, Fig. 20, shows approximately what leaf-spring steel will pull in pounds at 11½-in. draw. A 100 to 160-lb. bow is recommended. Extremely heavy bows over 300 lbs. drawing weight make nice exhibition pieces for flight or penetration shooting, but are no fun to shoot as you seldom retrieve the arrow intact if at all. It is prac-

3/16"	About 2½
7/32"	About 2
1/4"	About 2

tical, however, to make two or three bows of different weights, all interchangeable on the same stock.

Bow strings: Bow strings for wood bows can be purchased or made from 6-cord flax thread. This kind of thread is used in stitching machines by shoemakers. Twelve threads will hold wood bows to 80 lbs., the loop at the end being made by turning the whole string back on itself. The string for a 23-in. steel bow is made on a simple wooden form, as shown in Figs. 17 and 18. In this case, the string is divided into equal parts to make the loops. Both loops and a distance of 4 in. at center are wrapped, and the completed string is waxed with beeswax. The string can be shortened by giving it several twists before fitting to the bow. The triangular-boxed figures in table



Arrows are made from 5/16-inch birch dowel. The vanes are cut from celluloid and are fitted in the grooves cut in the shaft



Fig. 27 shows one way of cutting the grooves, the shaft being held in the lathe, positioned by the indexing head, while a rotary hand tool mounted in a slide rest does the cutting. Vanes are mounted at right angles, Fig. 26, instead of the usual triangular pattern used for long bow arrows. This method of mounting provides perfect ruddering for smooth, straight flight and, at the same time, fits the mechanical construction of the crossbow.

Cocking lever: Bows up to about 100 lbs. drawing weight can be set by hand; over this weight it is necessary to use a cocking lever. Fig. 28 shows the construction and dimensions of a cocking lever for 11 1/2-in. draw. The galvanized-wire hook which slips under the bow will automatically assume a bent position the first time it is

used. Photo Fig. 7 shows the manner of using the lever. If the release is set slightly forward, the trigger will cock automatically when the string engages the rear prong of the release.

Shooting: After cocking the bow, the cross bow is shot very much like a shotgun, sighting down the arrow to the target. A little practice will enable you to judge the range and drop of an arrow very nicely. When hunting, the bow can be carried cocked but without arrow. When not in use, the steel bow is left braced, but the wood bow is unstrung. Needless to say, any bow over 100 lbs. packs a terrific drive, and the utmost caution should be exercised in its use. Never fit an arrow in place until you are ready to shoot, and don't point the gun in any other direction than toward the target when the arrow is in place.

Three Simple Ways You Can Preserve Linseed-Oil Putty

To assure a supply of soft putty whenever needed, pack it in a jar having a tight-fitting lid. Level off the putty and cover it with raw linseed oil to a depth of 1/4 in. Do not use boiled oil. Before use, pour off the oil and take out the required amount of putty and repack the remainder. If the putty is too soft when removed, work in a

little whiting. To do this, cut the putty in small pieces, sprinkle on the whiting and knead the mixture to the desired consistency. If you just want to keep putty soft overnight in hot weather, place it in a jar and cover it with water. You can keep putty for a few weeks by wrapping it in waxed paper before putting it in water.

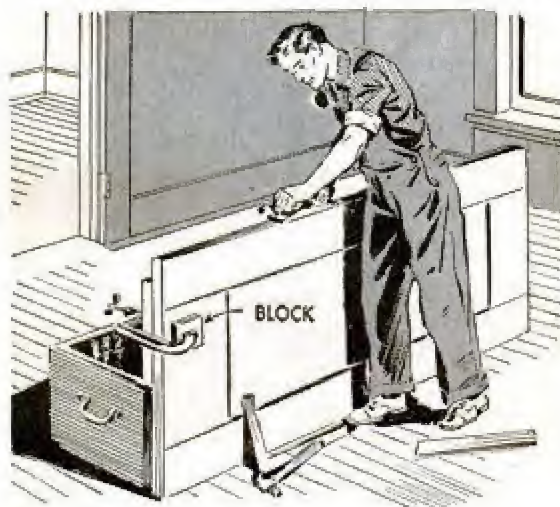
Escape of Small Chicks From Pen Prevented by Burlap Apron



When a portable pen is used for brooder chicks, considerable time often is spent hunting for sticks and stones to plug escape holes that are certain to be present when the pen is placed on rough or uneven ground. All of this work can be eliminated by attaching a curtain or apron of burlap around the inside of the lower frame members. By tucking the apron inside the pen each time it is moved you will provide an effective stop which will prevent chicks from squeezing through small openings.

Door Clamped to Tool Chest To Support It for Planing

Often called to fit doors and windows where he would not have the facilities of his shop, one carpenter avoided the usual difficulty of supporting them on edge for planing by simply clamping the work to the opened lid of his tool chest. A large



C-clamp with blocks placed under the jaws to protect the work surfaces will hold the assembly together.

Cleaning-Rod Stop Protects Rifle

If you have injured your finger when forcing a cleaning rod through a rifle, you will appreciate this simple stop. Formed on the rod with solder, it keeps the rod from slipping through the gun to its extreme length when the cleaning cloth emerges from the opposite end. The solder also helps prevent injury to the end bore of the gun by contact with the wire finger loop.



Removing Scratches From Badges



Identification badges worn by employees of defense plants eventually become scratched so that the plastic faces have a matte appearance and are no longer transparent. The transparency can be restored by flowing an even coat of

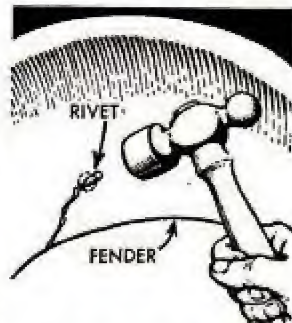
clear fingernail polish over the surface and allowing it to dry. Polish remover or lacquer thinner can be used in the same way with most badges having celluloid fronts.

—Kenneth Murray, Baltimore, Md.

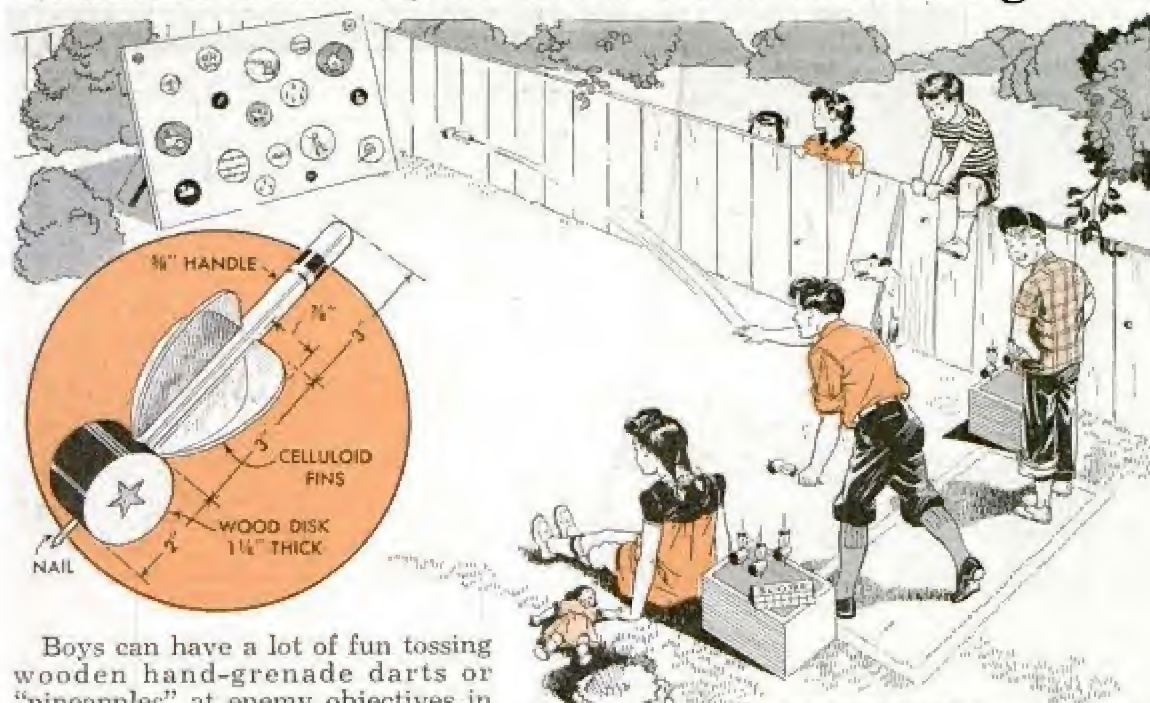
Simple Repair for Torn Fender

It's a simple matter to keep a tear in a fender from spreading until it can be welded. Just drill a $\frac{1}{8}$ -in. hole at the end of the tear, then place a soft rivet in the hole and peen the end tightly against the metal, holding an anvil against the rivet head to keep it in place while peening it.

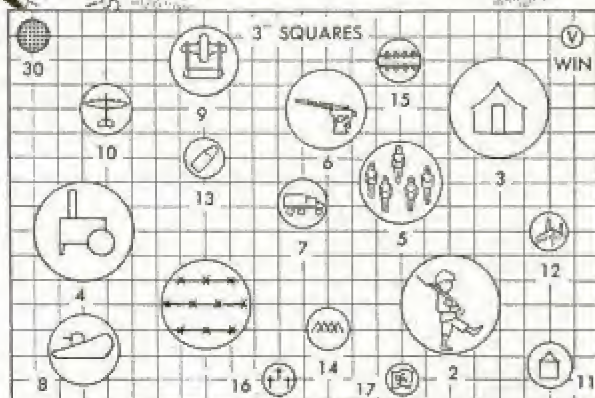
—John Krill, Youngstown, Ohio.



Grenade Dart Game Tests Your Throwing Skill

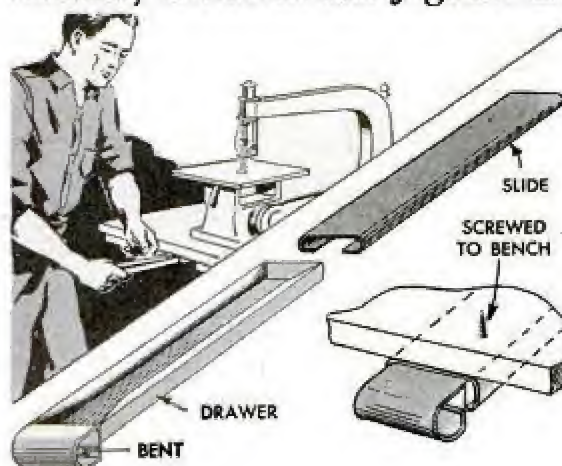


Boys can have a lot of fun tossing wooden hand-grenade darts or "pineapples" at enemy objectives in this game, which is easy to build, and can be set up in a backyard, garage or play room. The pineapples are hardwood disks fitted with finned throwing handles and spiked noses. For the target, old boards are covered with wall-board or corrugated cardboard on which circled figures or symbols are painted. The largest circles near the center of the board, which register low scores, are easiest to hit, while the smaller ones have greater scoring values. Each player starts with five darts. The player first scoring 101 or more points wins unless a lucky player hits inside the V-circle at the upper right corner, which wins the game. However, if a dart misses the board on the right side, the



player loses 5 points; 4 points on the left side, 3 over the top and 2 if the dart falls short at the bottom of the board.

Handy Drawer for Jigsaw Blades Made From Curtain Rod



Screwed to the underside of your jigsaw bench, two or more of these little drawers will keep the blades handy. Each drawer is made from two pieces of flat, telescoping curtain rod. The outer part of the rod is screwed to the bench and serves as the slide, and the drawer is shaped from the inner part of the rod. The sides are cut away at one end, which is bent up to form the rear end of the drawer. The other end of the rod is treated in a similar manner, except that the sides are cut back far enough so that the metal can be bent up to form the drawer end, then be bent outward and downward to form a finger grip.

—Patterson Mack, Ann Arbor, Mich.

*Steps
in folding*

FOLDER *Speeds Making of*

Place gauze on folder with side edge on guide line. Other edges overlap

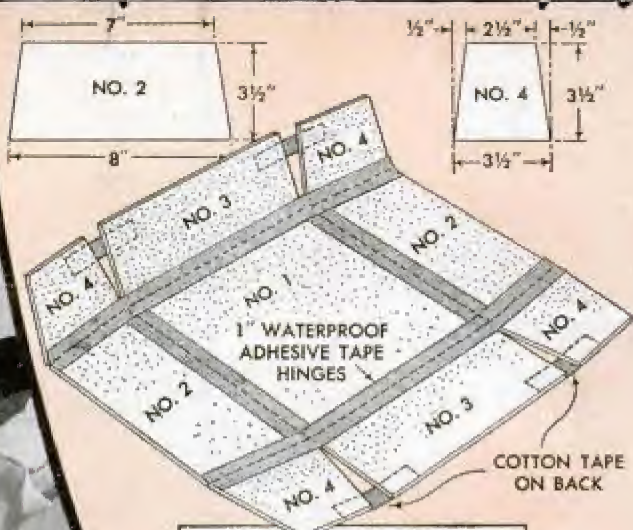
Lift side pieces 3 and 4 simultaneously and bring down flat to make folds A

Lift pieces 3 and 4 from gauze; bring down pieces 2 and 4 to form folds B

END OF GAUZE FOLDED AT AN ANGLE

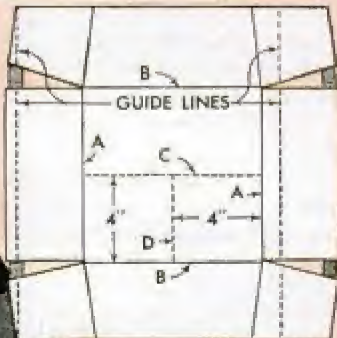
Completed 8-in. square of gauze is now folded by hand over fold line C

Final fold on line D produces 4 by 4-in. pad. On other sizes, fold E is made



4 by 4-in. Size

- NO. 1—8" X 8"—1 REQ'D.
 - NO. 2—3 1/2" X 7" X 8"—2 REQ'D.
 - NO. 3—3 1/2" X 7 3/4"—2 REQ'D.
 - NO. 4—(SEE PATTERN)—4 REQ'D.
- (All pieces cut from 1/8" tempered hard-pressed board)



THIS EDGE TOWARD YOU LETTERS POINT TO FOLDING LINES

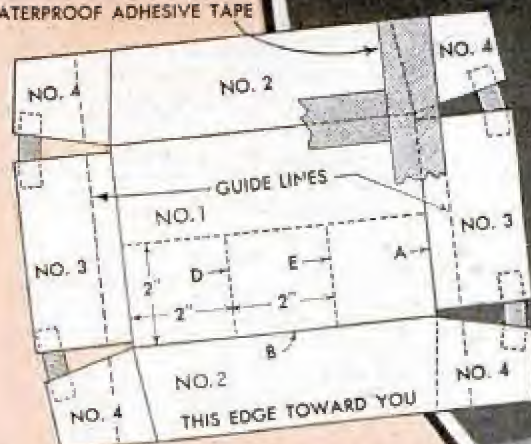
By
R. E. Fairchild

ASSURING neatness in all details, these surgical-pad folders triple the number that can be produced by hand, and require less handling of the gauze. The usual hand job of tucking in the four corners, or "mitering," is done automatically, the cut edges being drawn in at a slight angle as shown in the left detail above.

Three sizes of folders are given, the one above is the 4 by 4-in. size, the upper right detail giving the dimensions of the pieces comprising it, and the lower right detail showing the guide and folding lines, which are referred to by letter. The boards are cut from tempered, hard-pressed board, 1/8 in. thick. The edges are sanded smooth, after which surfaces and edges are coated with shellac to prevent fibers from rubbing off.

SURGICAL DRESSING PADS ..

1" WATERPROOF ADHESIVE TAPE



2 by 2-in. Size

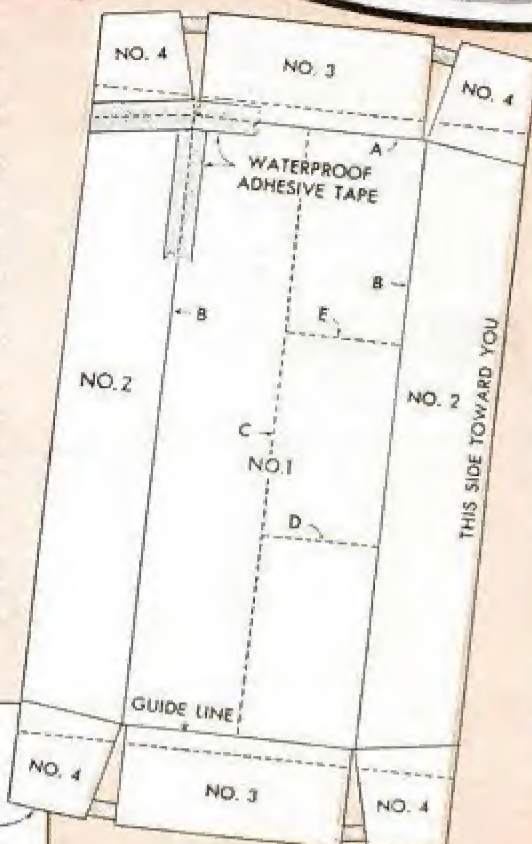
NO. 1—4" X 6"—1 REQ'D.
NO. 2—1 7/8" X 5 1/2" X 6"—2 REQ'D.
NO. 3—1 7/8" X 3 3/4"—2 REQ'D.
NO. 4—(SEE PATTERN)—4 REQ'D.
(Use 1/8" tempered hard-pressed board)
Letters point to folding lines

Waterproof adhesive tape, 1 in. wide, is used to hinge the parts together, and strips of cotton tape, glued to the underside of pieces 3 and 4 connect these together to permit folding in two directions. Guide and folding lines are made with a ruling pen, using signwriters' Japan colors thinned with turpentine. Assurance against any paint chipping off is provided by covering the lines, when dry, with varnish. Before using the folders, dust the surface of the adhesive tape with starch or talcum powder and wipe off carefully. Treat in the same way the sticky surfaces of adhesive tape that are exposed from the underside of the board.

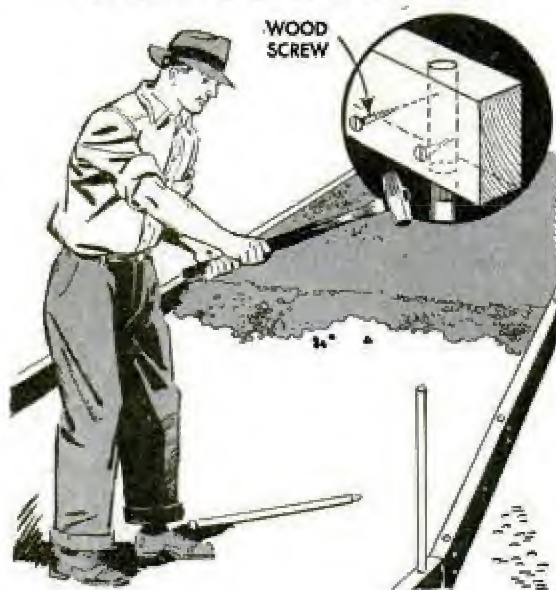
After making the second fold with pieces 2 and 4, and you find that the gauze overlaps slightly at the center, press the edges apart gently; if the overlap is 1/2 in. or more, undo the last two folds, slip the gauze down over the edge of piece 2 closest toward you and refold, after which you refold at the top in the same way. When pads are finished, the corners can be made even and the edges flattened with a spatula or table knife.

4 1/2 by 8-in. Size

NO. 1—9" X 24"—1 REQ'D.
NO. 2—4" X 23" X 24"—2 REQ'D.
NO. 3—4" X 9" X 8 3/4"—2 REQ'D.
NO. 4—(SEE PATTERN)—4 REQ'D.
Letters point to folding lines



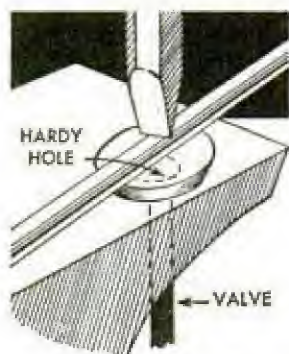
Wood Edging Staked to Ground Retains Gravel Driveway



When I built a slag-filled driveway, I used 10-ft. lengths of 2 by 4-in. stock along each side to retain the loose material. Before putting down the sides, however, I drilled three 1-in. holes in each one and applied two coats of creosote. After lining up and leveling the sides, they were anchored with wooden stakes creosoted and driven through the holes flush with the top edges of the sides. Screws driven through the sides into the stakes made the assembly rigid.

—John Richmond, Euclid, Ohio.

Auto Valve Stem Saves Anvil Face When Cutting Rods With Chisel



You can save the face of your anvil from cold-chisel marks by keeping a discarded auto valve stem at hand. When dropped through the hardy hole, the valve provides a protecting surface upon which cutting may be done.

Rawhide Makes Good Packing For Worn Water Pumps

Piston rods in water pumps often wear so that they are off center or of varying diameters, which makes it almost impossible to pack the stuffing boxes so they won't leak. While not always a complete cure, the following method of packing the

pump is worth trying: Instead of the usual type of packing material, try rawhide cut into very thin strips—not more than $\frac{1}{16}$ in. wide. When exposed to water, rawhide swells and also becomes quite resilient, thus making a very tight fit around the piston rod to prevent passage of water.

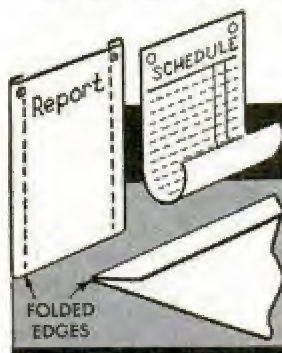
—J. H. Dunewin, Grand Rapids, Mich.

Sewing-Machine Belt Aids Grip On Hammer Handle

Gripping a hammer handle when wearing gloves often quickly tires the arm and hand. To provide an easier grip with a gloved hand, one carpenter wraps the handle with a length of leather sewing-machine belting as shown. The round belting is wrapped tightly and is held in place at the starting and finish ends with brads.



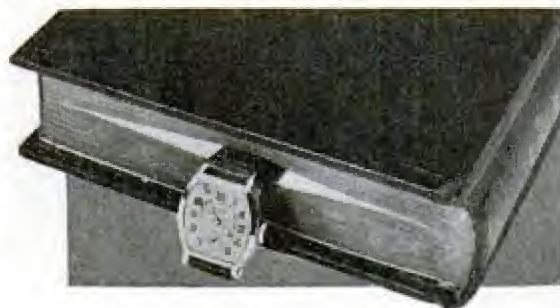
Bulletin-Board Papers Stay Flat When Folded on Side Margins



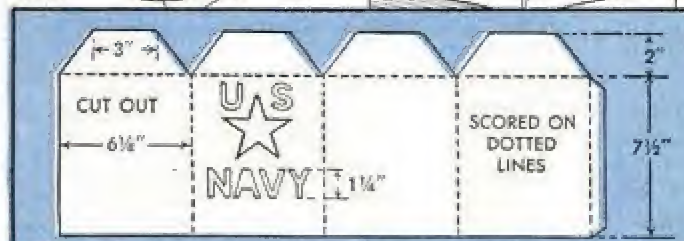
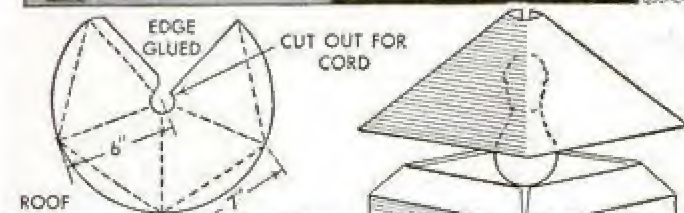
Reports, schedules and other items posted on bulletin boards are apt to curl so that they cannot be read easily. To keep them flat against the board, one office manager folds each sheet along each side, as shown.

Book Serves as Watch Stand For Bedside Table

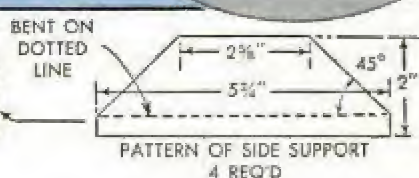
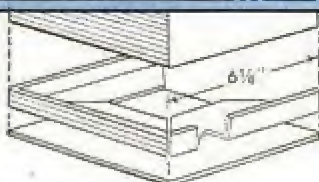
In an emergency, a book can be used as a stand to support a wrist watch so that it can be seen from your bed. Just fold the watch band and insert it between the pages of the book, allowing the watch to be supported in a vertical position as indicated.



Service Star Is Illuminated for Night Display



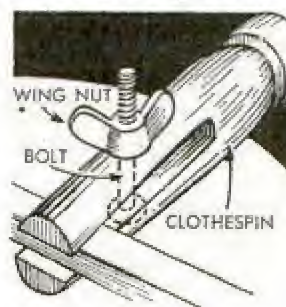
For a service star that shows as attractively at night as it does in the daytime, hang a lantern like the one shown in your window. You can make it from heavy cardboard. For the sides, cut a piece as shown in the lower detail, score the outside surface where it is to be bent so that it won't break when folded, and cut out the lettering and star with a razor blade. Glue white paper to the inside surface behind the openings to soften and diffuse the light. After the sides have been bent to shape, cover each corner with 1-in. cellulose or adhesive tape. The bottom fits inside the lantern, and is a square piece of cardboard fitted with side supports or glue tabs as shown in the lower detail. The center detail shows how the top is made and fastened in place. The lantern is illuminated with a lamp of low wattage, such as a 110-volt Christmas-tree bulb on a drop cord, which is inserted before the ends of the roof are brought together and glued. Gold paper or gold bronzing paint will make the top more attractive. For the sides, use showcard paint of a color appro-



priate to the particular branch of the service represented, and paint the tape at the corners white.

—Dick Hutchinson, Ithaca, N. Y.

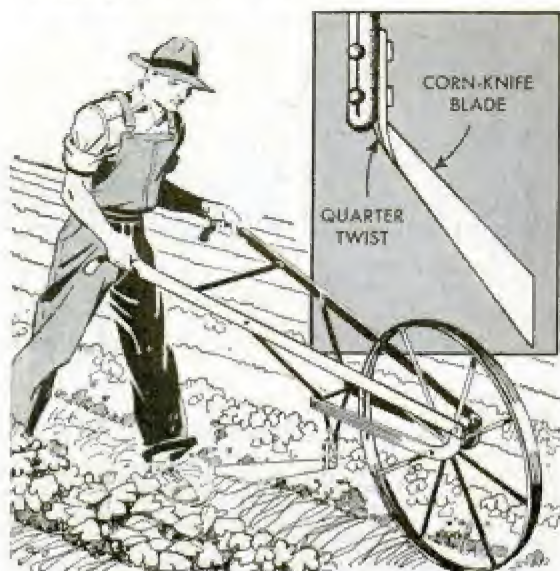
Clothespin Used as Pin Vise



The next time you need a pin vise for some light work and none is at hand, it is a simple job to make one from a clothespin. Just cut off the legs as indicated, and then drill through

them and insert a small bolt. Turn a wing nut on the bolt and your vise is done. A vise of this type also will be found handy for holding fishhooks while tying flies.

Long Strawberry-Plant Runners Cut Quickly With Garden Plow



To keep runners of strawberry vines from covering the space between rows, one gardener cuts them off quickly and easily with a knife attachment on his garden plow. The attachment consists of a corn-knife blade substituted for one of the plow attachments. The tang of the blade was heated and bent so that the knife assumed the position shown in the plow.

Putty Aids in Checking the Pitch Of Outboard-Motor Propeller

Two blocks of wood and a piece of putty are all you need to check the pitch of an outboard-motor propeller. Accidental contact with underwater objects frequently results in upsetting the pitch of one blade of a propeller and causes vibration. The first step is to bolt the damaged propeller to a heavy block of wood. Then find a piece of wood that will slide freely under the blades. On top of this is placed a piece of putty of heavy consistency. Adding a sheet of oiled paper to the top of the putty will keep it from sticking to the blade. Then, the propeller is turned to leave the



imprint of the undamaged blade on the putty. The position occupied by the block of wood carrying the putty should be marked on the large block. Now, sliding back the block with putty, the propeller is turned to bring the damaged blade into the position previously occupied by the good one. Then, by sliding the block of wood and putty back under the damaged blade, it is a simple matter to make a preliminary estimate of the damage. It is frequently possible to pad the jaws of a wrench and use this to bend the damaged blade back to shape. Work carefully on aluminum propellers as they may break. Bronze propellers, however, can stand considerable twisting. If the damage is severe, it may be necessary to remove the propeller and reshape it with a mallet, using a block of wood as a pad to prevent denting the metal. Progress should be checked at frequent intervals with the putty as a gage.

Spices Transferred to Metal Cans To Help Keep Them Fresh



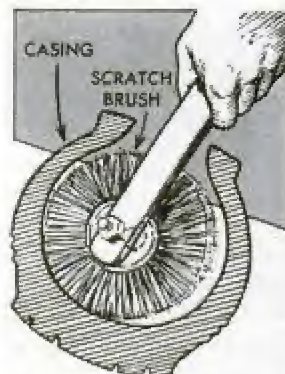
Metal containers have gone to war, so save old metal spice cans and transfer the spices from the new cardboard boxes to the metal ones. These will exclude air better than the new ones and keep the contents fresh longer. A corner cut from an envelope makes a handy funnel for transferring the spices.

—Benj. Nielsen, Aurora Nebr.

Old Scratch Brush Provides Tool For the Tire Repairman

Bolted to a wood or flat-iron handle, a worn wire scratch brush can be used to clean the inner surfaces of tire casings wherever adhesive patches or re-lining strips are to be applied. A 6-in. wheel is about the right size for most curved surfaces to be scraped. The brush action will remove dirt accumulations that otherwise would prevent the patch from sticking properly.

—W. C. Wilhite, Carlinville, Ill.

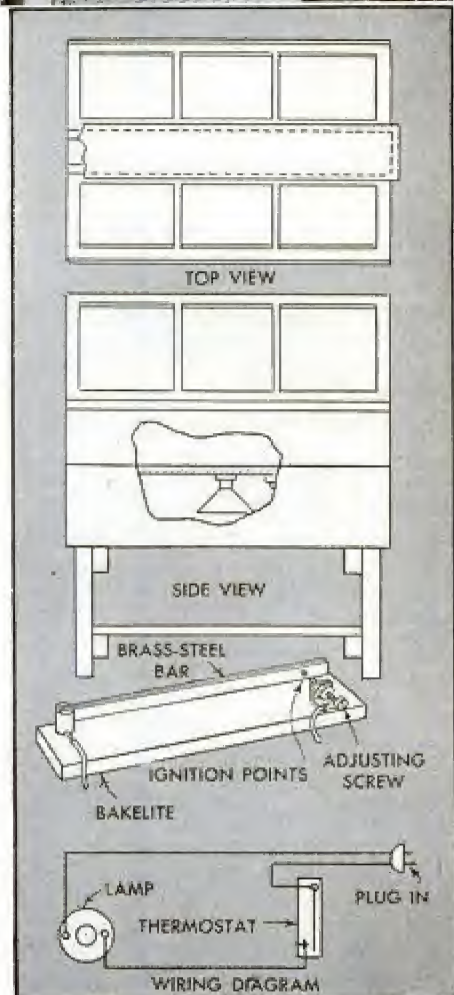
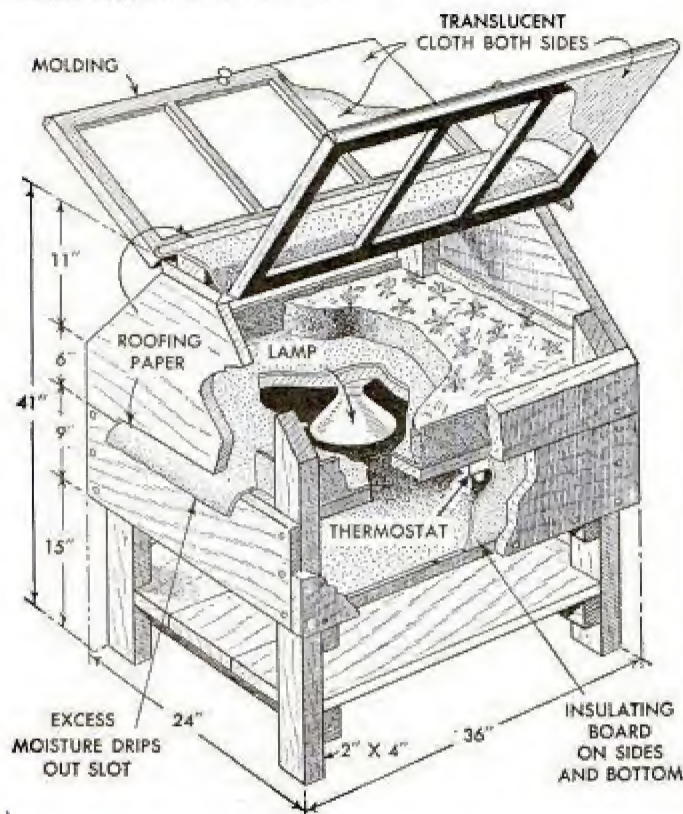


100 W.P.

Electrically-heated CABINET HOTHOUSE

has uniform temperature

JUST the thing for growing tender plants or for starting garden seedlings early, this compact little hothouse can be moved about at will, and maintains a uniform temperature for the plants by means of a 100-watt lamp that is controlled by a homemade thermostat. This consists of a strip of brass and a strip of steel sweat-soldered together, fitted with suitable points, and mounted as shown in the lower right-hand detail. The house is divided into two compartments, one for the heating unit and one for the soil. The heating compartment is insulated on the sides and bottom and the soil compartment is lined with asphalt roofing paper, which extends out through a slot at one end for escape of excess moisture. Two hinged frames serve as a roof for the house, and are covered on both sides with translucent cloth, which admits both light and the ultra-violet rays from the sun.



There Are Good Photo Subjects



There's no need to go far and wide to get good photo subjects when the world at home, in everyday life, is full of them. Why not make the most of seemingly trivial subjects and produce some outstanding photographs that tell stories?

by Fred G. Korth



NO DOUBT you've heard someone say that it's easy to make good pictures if you have unusual and beautiful subjects. Assuming that such a subject is well photographed, there's no doubt that attention-getting pictures will result, but this involves less ingenuity and resourcefulness on the part of the photographer than is the case with outstanding pictures obtained from commonplace subjects. Many people travel far for unusual scenery. Some photographers come back from national parks with color shots of flower beds taken in front of hotels even though there are just as fine flowers to be photographed outdoors in almost any city park or indoors in park conservatories.

There are many possibilities for obtaining good photos in thousands of everyday subjects that are all around you and it's not much of a trick to find them. A now famous photographer once won a medal for a picture of a box of matches. So, why not start with a box of matches, a deck of cards, a set of garden tools or even an alley cat, to create something that tells a story. Just concentrate on something that seems almost too trivial to have any photographic possibilities. In using such trivial subjects, emphasis and exaggeration of one single detail often tell a story successfully. Such simple subject matter, if inanimate, is easy to handle and you can take all the time you need for arrangement and lighting effects to make unusual photographs.

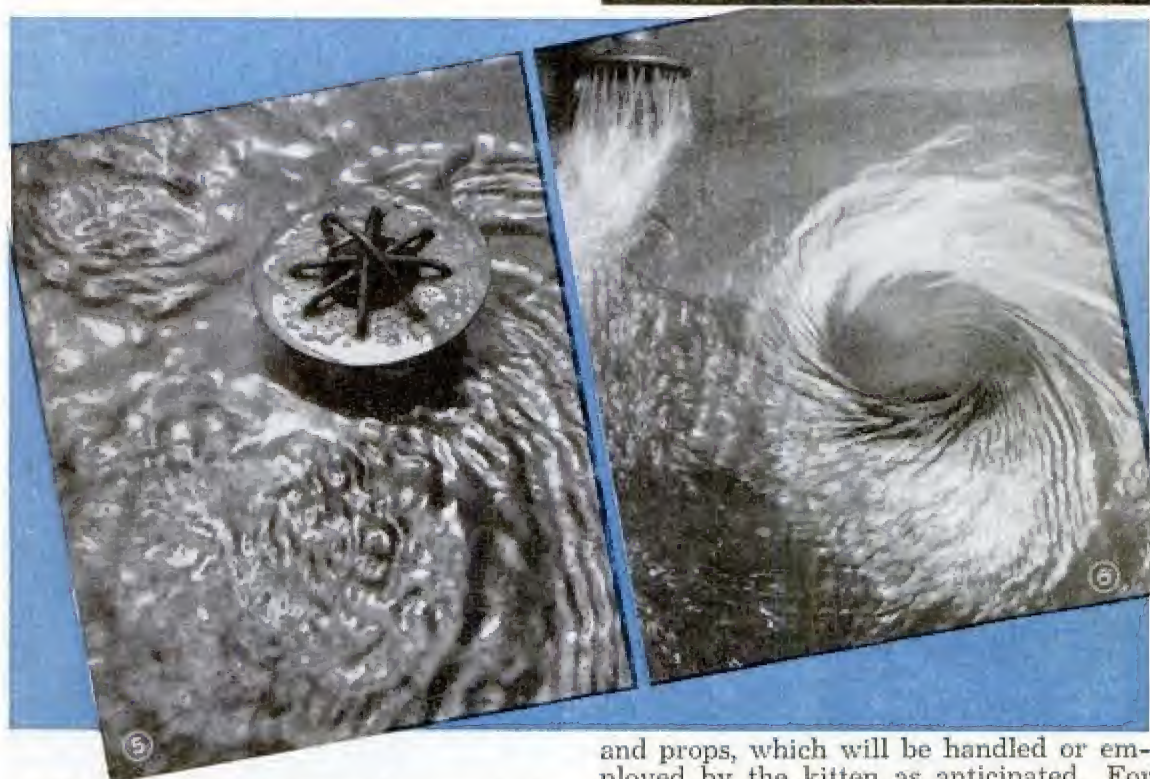
It's a good idea to have your camera loaded and always at hand, keeping an eye open for unusual subjects that daily cross your path. Very often some of the most interesting pictures will be the result of something that you notice casually and perhaps there will be no opportunity to take a picture of it at another time. For instance, snow on tree branches, which often produce striking pictures, may vanish in an hour's time, so snap it while you have the chance. Shots of people in character-

All Around You

istic poses often make excellent pictures. For instance, there may be some friend who is always complaining about the hard work he is doing at the office especially after being up late the night before. He will keep on yawning, so why not take a shot as shown in Fig. 1? With little effort he will look perfectly at ease while doing so. His friends will agree that this is a more typical pose of him than any stiff studio portrait.

Some day your little son may come home from the baseball game with a terrific black eye although he may not be much upset about it. So, you might use the black eye as an important point in a picture. With cold cream and a little dirt you can make him up for the camera, and with the addition of a pair of boxing gloves you can get poses such as shown in Figs. 2 and 3—a little toughy, your own "East-side kid." He will never look the part of "boy" as much in his best Sunday suit.

Pets are always interesting picture ma-



terial. Dogs will obey and behave fairly well in front of a camera, but rare is the cat that will understand how it is expected to perform, and little kittens are hopeless for a trained act. So, if it's a picture of a kitten you are after, watch it play and get a "natural" shot. Knowing how it plays, you can often provide a suitable setting

and props, which will be handled or employed by the kitten as anticipated. For instance, after putting it inside a paper carton, you may expect it to crawl out, perhaps gingerly as in Fig. 4, giving you plenty of time to take the picture under prearranged lighting and positioning.

You can get action pictures of inanimate subjects in everyday life. While not involving majestic and awe-inspiring spec-



bottle is facing the camera necessitating a very short exposure and small lens stop. Fig. 7 shows a picture made in a similar way of a number of bottles set on a pane of glass with illumination underneath. The bottles were placed in as harmonious a position as possible, after which the lamp was moved about until the most interesting effect was produced. In doing so, the heat of the lamp caused the slight moisture to rise and condense in the tops of the bottles. The picture was taken with a small lens opening for focus and a relatively slow exposure to compensate for the weak light underneath.



tacles such as water dashing over Niagara or Yellowstone Falls, or surging against boulders in a mountain stream, there is dashing water at home. Attractive patterns of running water are made right in your kitchen sink or in a darkroom print washer, where the water whirls around the overflow. Water reflects considerable light. If you hold a flash bulb in a reflector right above the portion of the whirling surface you can make a good shot like the one shown in Fig. 5 in one two-hundredth of a second. Fig. 6 shows a similar picture which resulted after the overflow was unscrewed. Water pouring into a funnel and from there into a bottle is the subject of Fig. 8. Even the bubbles of air in the water can be seen. Note the light behind the

Fig. 9 shows smoke coming from two candles of which the flames were just extinguished. Two photo-lamps were pointed at the candles, and a $1\frac{1}{2}$ -second exposure was made. In making such a shot, the flames are "pinched out" quickly with two fingers of the hand just before operating the camera on "bulb" with the other hand. When the hand moves away from the candles it draws air and with it smoke in a pattern away from the candles. That is the moment to operate the shutter. If the pattern does not suit you, light the candles and repeat until the right effect is obtained.



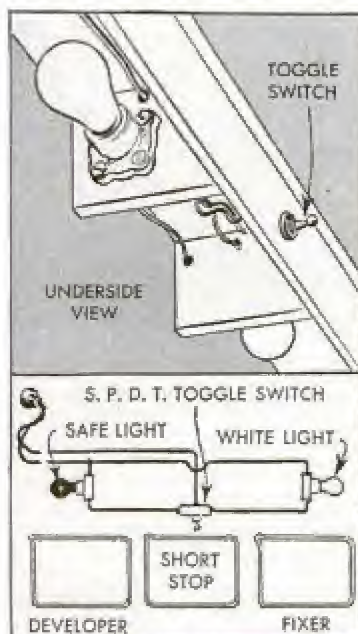
Shaving Mirror Used as Reflector and Spotlight



If you do not have the necessary light for some special lighting effects you want to try, a convex shaving mirror may do the job. It can be placed to reflect the light to the side of a subject opposite the light source as above, or it will throw a beam of light like a spotlight when used with a floodlight as shown at the right.



Two-Way Lights Mounted on Sink Speed Up Developing



Time can be saved in developing prints if a quick means of switching from safelight to white light and back again is provided. This can be accomplished by nailing a baffle on the front of a shelf overhanging the sink and mounting the lights behind it. The lamps are controlled with a single-pole, double-throw toggle switch having a neutral middle position. Throwing the toggle to one side lights the safelight for developing, while throwing it to the other side turns on the white light for inspection. In the center, both lights are off.

Movie Titles Written on Cellophane Slate Give a Variety of Effects

You can create effective disappearing movie titles with the use of a slate of the type which "erases" its letters simply by pulling up the top sheet of cellophane. Try writing part of a word, photographing it, stopping the camera and finishing the word. Continue in the same way with the

rest of the title. On the screen the title will seem to be writing itself. If you lift the cellophane slowly while photographing, you can make the writing disappear word by word, or pull it quickly, and the writing vanishes at once. With practice you can devise other effects of the same nature.

Cardboard Cutout and Spotlight Make Interesting Background



Interesting photographic effects can be obtained by shining a spotlight through cardboard cutouts to throw patterns on a dark background. A music stand makes a convenient support for the cutouts, which may be cut to represent the moon, trees, buildings or other shapes. The size of the image on the background may be varied by changing the position of the cutout.

Cut Film Held in Notched Sticks While Drying on Line

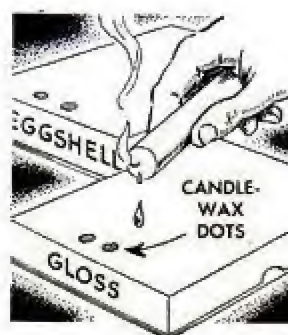
Claimed by one photographer to be better than clothespins for holding cut film while it dries, several of these notched sticks can be made in a few minutes. The



films are bent slightly to allow the ends to slip into the notches on one side of the stick, the third notch serving as a hook to suspend them from the line.

Wax Dots Aid Identification Of Print Paper in Dark

To identify boxes of print paper in the dark-room one photographer marked the boxes with drops of candle wax, which can be detected by running a finger over the surface. A simple code of dots can be memorized easily.



"Ground Glass" Spot on Bottle Takes Pencil-Written Label

Grinding a frosted spot on the outside of a bottle on which the label information can be written easily with a pencil does away



with the necessity for using paper labels which may be soiled, torn or otherwise marred. After a fine silicon-carbide stone has soaked in water for a few minutes, use it to grind a spot on the bottle as large as you wish, keeping the stone wet. A circular grinding motion is most effective.

Proper Care of Cemented Filters

Cemented filters should never be washed with water. If they are too soiled for ordinary methods use a fine tissue paper, very slightly dampened in denatured alcohol, rubbing lightly. Before cleaning, make sure both the filter and material are free of grit which might cause scratches. Also avoid getting these filters in extreme heat, as it softens the cement and allows air to enter between the glass disks.

—Robert Ely; Bakersfield, Calif.

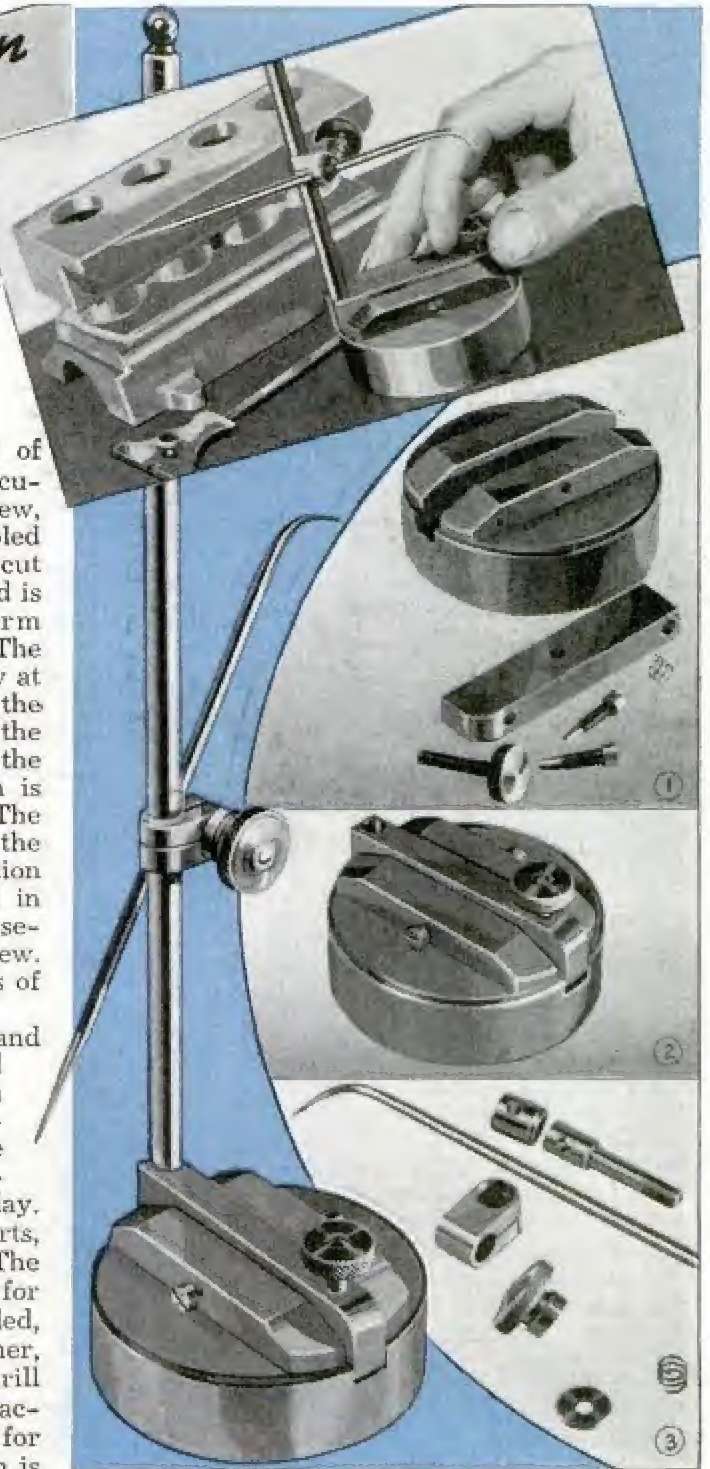


SHOP NOTES

Make Your Own SURFACE GAUGE

DESIGNED for a wide range of adjustments, easily and accurately made by an adjusting screw, this surface gauge can be assembled from scrap metal. The base is cut from a piece of 3-in. steel bar, and is grooved to receive a rocking arm which is pivoted in the center. The arm is adjusted by a thumb screw at one end, which works against the pressure of a small, stiff spring at the other end. The rocker supports the spindle, the lower end of which is threaded and screwed in place. The clamping head, which holds the scriber, moves freely to any position on the spindle while being held in place by a friction spring until securely clamped by a thumbscrew. Fig. 5 shows the sizes and shapes of all parts.

First, the base is turned to size and shape, after which the groove and rocker support are machined in a shaper, taking care that the rocker is a snug, accurate fit in the groove, free enough to move without binding, but with no side play. Fig. 1 shows the base and its parts, while Fig. 2 shows it assembled. The photo, Fig. 4, shows how the holes for the rocker pivot screws are drilled, first from one side and then the other, finally running a slightly larger drill through both holes to align them accurately. They are then tapped for the pivot screws. The rocker arm is



Disk Keeps Fowls Off Fountain

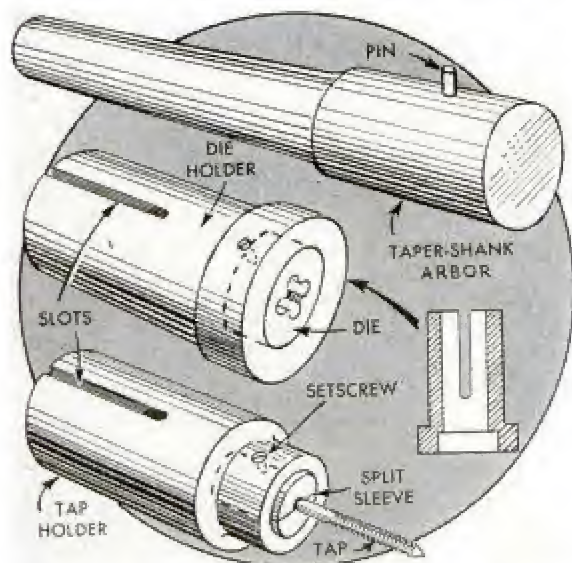


If your chickens have a habit of roosting on top of their drinking fountains or feed hoppers, just suspend an old harrow disk above each one as indicated in the drawing. This will dip

and swing if a fowl attempts to alight on it and will soon discourage the habit.

Holders to Use Taps and Dies In Small Bench Lathes

Production threading can be done in a small lathe with this tap and die holder, which consists of a shank having a Morse taper and two sleeve heads, one to hold dies and the other to hold taps. Both heads are slotted to straddle a pin in the shank, and the tap head is provided with split sleeves to take taps of various sizes, the sleeves being retained by a setscrew, as are the dies in the die head. In use, the holder is put in the tailstock and the work is ro-



tated in the headstock, the lathe being turned by hand to start a tap or die, after which the power is turned on at the slowest speed. In this way, the tap will feed itself into the work until the slot in the head passes the pin in the shank, after which the head will spin with the work, thus stopping the action of the tap or die. In removing the latter, the process is reversed, first moving the tailstock spindle forward to engage the slot with the pin, then reversing the lathe and backing off the tailstock as the tap comes out of the work.

Self-Locking Latch Permits Gate To Swing in Two Directions

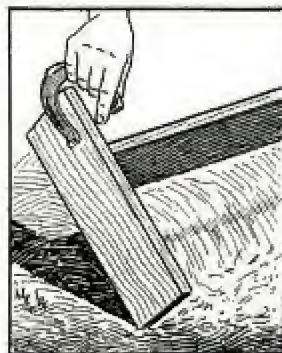


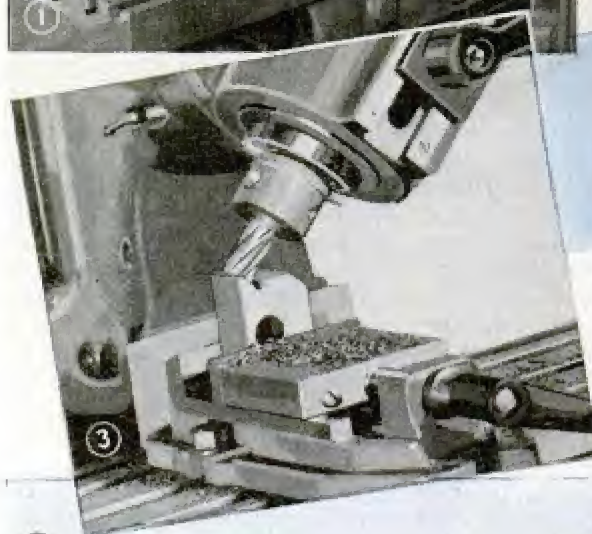
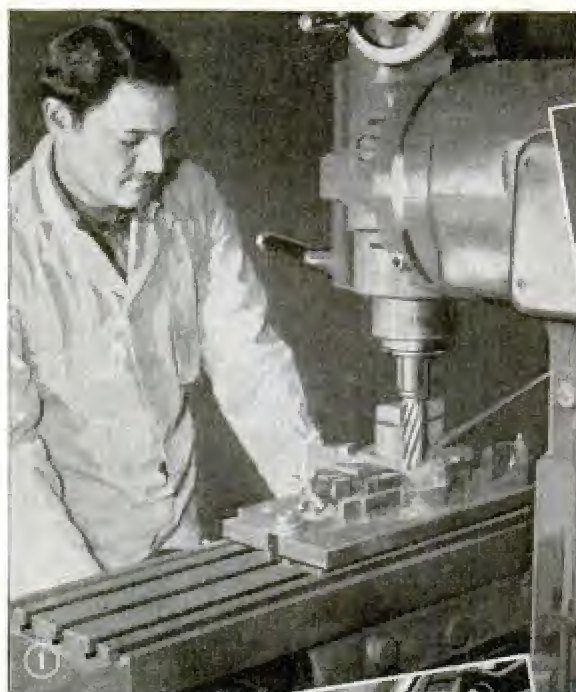
Needing a latch that would permit a gate to be swung in either of two directions, a farmer made this one, which automatically locks when the gate is closed. The parts were forged from scrap pieces of flat iron and consist of a striker plate and two pivoted arms, the arms being tied together at the top with a spring. This keeps the lower ends of the arms down against the striker plate, but permits an arm to rise when a projecting metal piece on the gate strikes it in closing. Movement of the upper ends of the arms is limited by two wide staples made from heavy wire or two long nails. Thus, when the gate projection slips under one of the arms, it cannot pass from between them until pressure on the upper end of one arm raises the lower end. The latch is mounted on two heavy wooden blocks, which are bolted to the gate post, the latter being notched as indicated for the gate projection.

—A. M. Wettach, Mt. Pleasant, Ia.

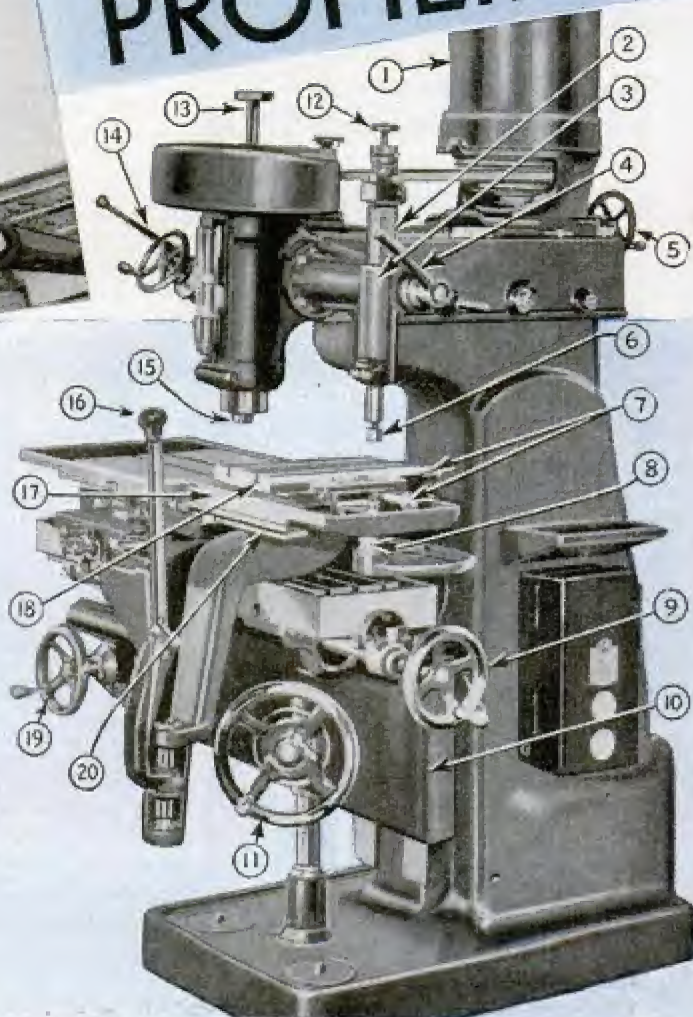
Horseshoe Handles on Trough Provide Grip for Lifting It

When a large hog trough becomes filled with rain water, it is difficult to raise and tip when emptying for cleaning. If a horseshoe handle is nailed to each end of the trough this task will be greatly simplified.

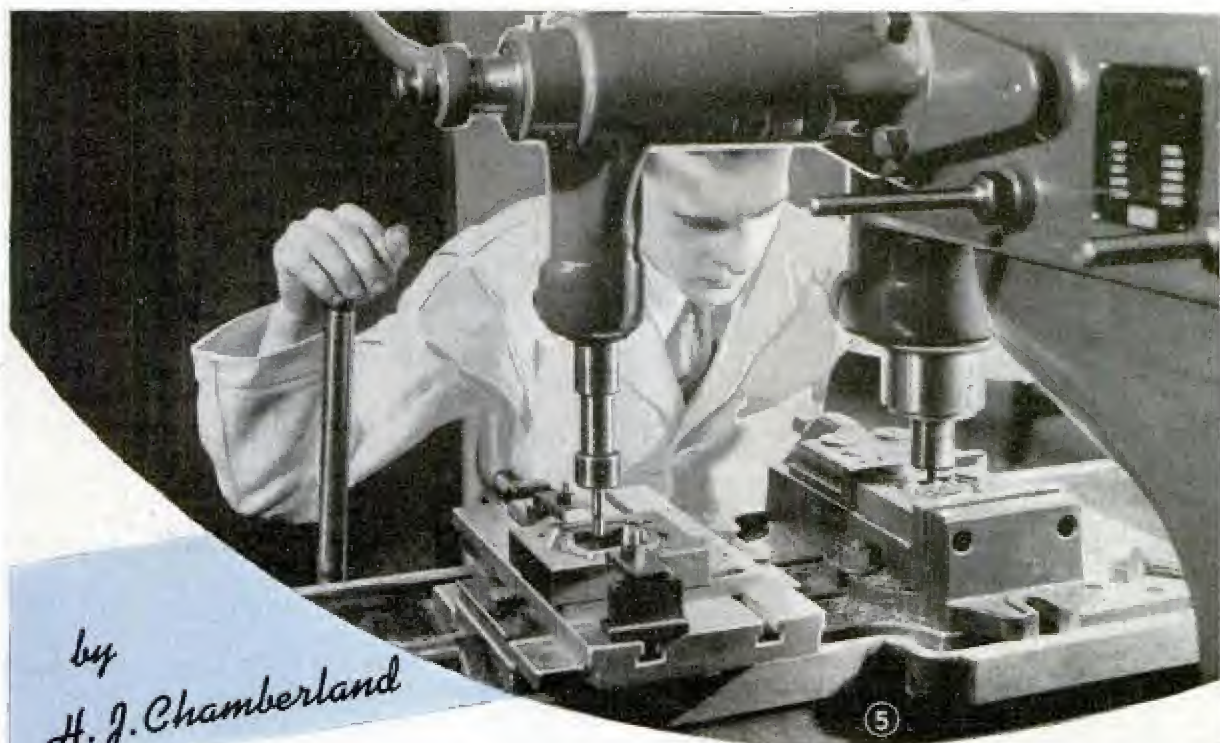




Simplified PROFILING



- ①—Spindle motor-variable speeds
- ②—Tracer-spindle housing
- ③—Tracer-spindle head
- ④—Vertical adjustment right-hand lever
- ⑤—Belt-tension handwheel
- ⑥—End of tracer or duplicator spindle
- ⑦—Micrometer screw for precisely locating master
- ⑧—Clamp bolts for locking duplicator table
- ⑨—Handwheel to operate machine table
- ⑩—Machine saddle
- ⑪—Saddle vertical-adjustment handwheel
- ⑫—Micrometer adjustment for tracer spindle
- ⑬—Draw bolt for machine-spindle collet
- ⑭—Lever and handwheel with micrometer adjustment for vertical movement of cutter and tracer spindles
- ⑮—Machine spindle
- ⑯—Lever for full lateral movement of duplicator table
- ⑰—Duplicator table
- ⑱—Compound table for master
- ⑲—Crossfeed movement handwheel
- ⑳—Duplicator table operates on ball-bearing ways



by
H. J. Chamberland

ALTHOUGH band-filing, shaping and nibbling are some of the processes by which metals and nonmetals are cut to irregular forms, the shop term of "profiling" refers to an operation usually done in a vertical type of milling machine. Such a machine is versatile in its applications and, in addition to being indispensable for some jobs, it helps to reduce the cost on many milling operations. A large machine is used for bulky castings such as bases, saddles, tables, etc., while smaller units are better adapted for milling regular and irregular cuts on tool work and small parts. In the latter case, shank end mills up to 1½ in. in diameter, and specially shaped milling points do the cutting. These tools are quite inexpensive compared with those used for milling horizontally. Fig. 1 shows a 1½-in. end mill simultaneously facing and squaring two surfaces of a part held in a fixture, while in the milling-machine set-up shown in Fig. 2, a large end mill is used to cut blind slots in a steel plate. The spindle of the machine shown in Fig. 2 remains permanently fixed in a vertical position whereas the spindle of the machine in Fig. 1 is adjustable to two-way, 90-degree angular positions. As shown in Fig. 3, vees and single or compound angular cuts are possible with end mills costing considerably less than angular milling cutters. Although, with proper attachments, most modern vertical spindle milling machines can be readily converted into inexpensive jig-boring or die-making equipment, designs that have been found most

valuable are those incorporating features for simplifying the cutting of outlines, contours and raised or sunken portions such as lettering, all of which is classified as profiling.

Duplicator profiling: The duplicating machine shown in Fig. 5 is in reality a vertical milling machine to which is added a duplicator attachment consisting of a tracer head and an auxiliary table. Its purpose is to expedite the machining of dies, molds or parts regardless of the shape of the profile by reproducing them from a "master." Although the master die or mold must be made by a highly skilled workman, any number of identical parts can be reproduced quickly and accurately by the average milling-machine operator, or by an inexperienced hand who has been given a short period of training.

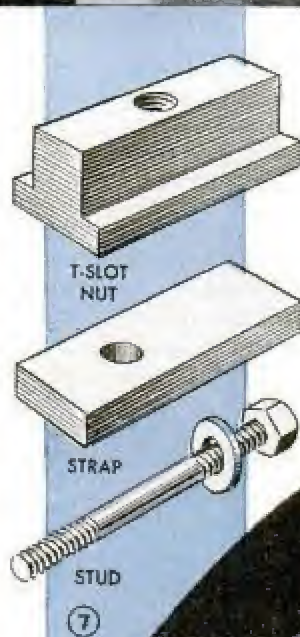
A machine equipped with duplicating attachments is shown in Fig. 4. The tracer head 3, fitted with spindle 6, which holds a guiding point or stylus, is fastened to the machine-spindle head with four cap screws. Provisions are made for accurate vertical alignment. The base of duplicator table, 17, is fitted to the regular table with four T-slot bolts. On the duplicator table is the master table, 18, which has longitudinal and traverse movements, plus micrometric adjustments to space the master accurately in relation to the tracer point and work. The duplicator attachment is simple to operate as there are no figures involved nor drawings to follow. Work and master must be positioned accurately in



relation to their respective aligning points. A few T-slot nut sets of the kind shown in Figs. 7 and 8 save time and assure positive clamping means of master and reproduction.

The operator controls the vertical movement of both milling cutter and tracer spindles with his left hand on the lever or hand-wheel, 14, Fig. 4, to raise or lower them as the tracer follows the contour of the master. With his right hand on lever, 16, the operator moves duplicator table, 17, laterally in any direction, permitting the cutting tool to reproduce the master profile. The tracer spindle and its point or stylus do not rotate. The duplicator always reproduces actual size. When a profile calls for a true circle or segment thereof, it can be milled with the use of a circular fixture such as shown in Fig. 6. The radius of the cut is governed by the distance between the cutting tool and the pivoting point of the fixture. Usually, the tracer spindle can remain bolted to the main spindle head.

Both spindles of the duplicator are identical in design and have lift springs to compensate for spindle weight and to remove backlash in the vertical feed gears. The vertical feed lever, 14, Fig. 4, is adjustable by means of a spring



compensator and feeds of .0001 in. are possible. It is obvious that the duplicator table must incorporate extra facilities for free movement if the tracer point is to function efficiently. This free movement is provided with a number of precision balls that roll in specially designed ball-bearing ways. The table lever, 16, adjusts the table to a convenient operating position. Sensitive movement of the table is also under adjustable friction control to suit light or heavy work. The table can be locked rigidly for setting up, indicating work or taking rough cuts directly with the screw mechanism of the machine. Being made of aluminum alloy of considerable strength, rather than of steel, the attachment is light in weight and therefore easy to fit or to remove from the machine.

Fig. 10 shows three typical examples of dies made by the duplicator process. The master punch and die from which

those in detail A were reproduced, cost \$150.00 but a milling-machine operator can make a replacement set for less than \$25.00. Die B for handles and die C for spoons were reproduced by workers who had never seen a machine until trained for duplicator work. Of the utmost importance is the selection of good end mills and milling points. The tooth design shown in Fig. 11 provides a free and clean-cutting end mill. Mills of this type have strong cutting edges, the angle and rake of which tend to remain constant as they are resharpened. The steep helix angle on the left one affords fast-cutting action for either four- or two-lip end mills. The small helix angle shown on the right one is for two-lip mills where accuracy is essential. Fig. 9 shows a typical assortment of two- and four-flute end mills and one-flute milling points. They come under six basic classifications as shown in Fig. 12, but there are also other shapes as shown in Fig. 13. There are about fifty cutting tools in a set, varying in size to suit nearly all requirements.

Pantograph engraving: Pantograph engraving machines, Figs. 14 and 17, are like duplicators in that they reproduce from a master. However, a pantograph differs from a duplicator in that it is a complete unit in itself and not an attachment on a milling machine. Also, on a pantograph, enlarged masters can be used so that small reproductions are possible, which result in increased accuracy. While a pantograph engraving machine can do all small work within the range of a duplicator, it is used chiefly for engraving letters, figures, symbols, serial numbers and special characters. Besides reproducing on flat surfaces, the pantograph can reproduce on concave,



SINGLE FLUTE
BALL NOSE



SINGLE FLUTE
SQUARE NOSE



SINGLE FLUTE
CONICAL



TWO FLUTE
SQUARE NOSE

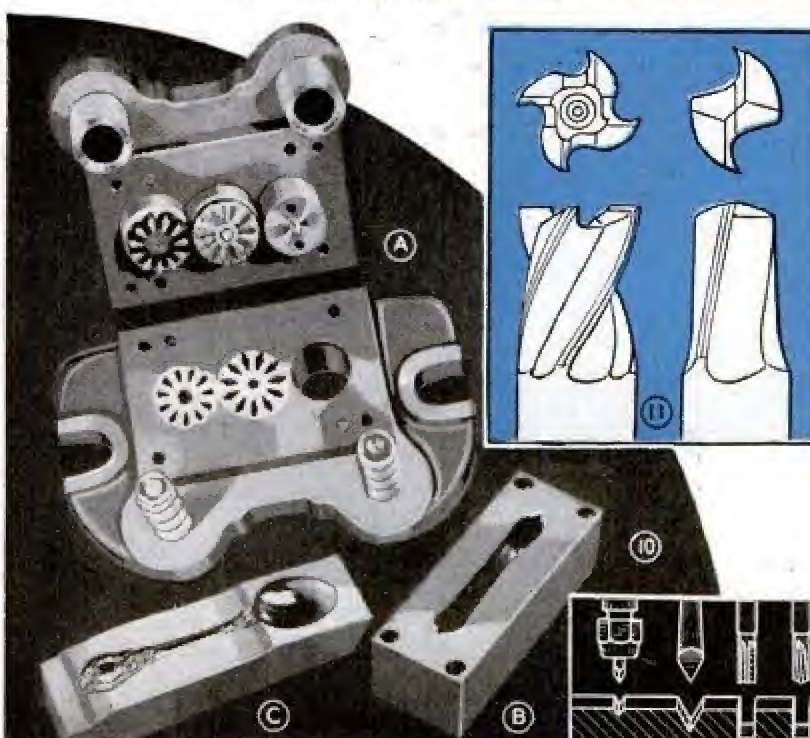


TWO FLUTE
BALL NOSE



FOUR FLUTE
SQUARE

12 SIX BASIC
CLASSIFICATIONS
OF END MILLS





convex or spherical surfaces provided the curvature is uniform within a radius of approximately $3\frac{1}{2}$ in. The cutter and tracer spindles of the pantograph shown in Fig. 14 are on the same horizontal plane, as is the case with a duplicator. The model shown in Fig. 17 differs in this respect as the tracer point is in an elevated position. The latter machine is known as a "munitions engraver" and is specially adapted for engraving precision tools, plates, dials and the like.

Master copy is the name given to the templates or patterns from which designs or characters are reproduced by pantograph engraving. There are three basic forms of copy type as shown in

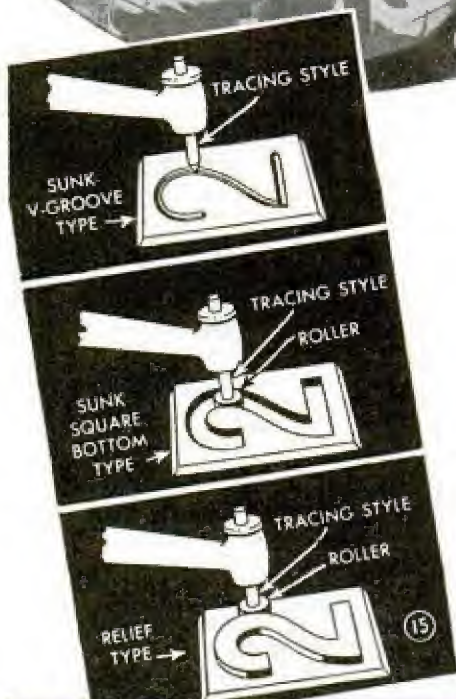
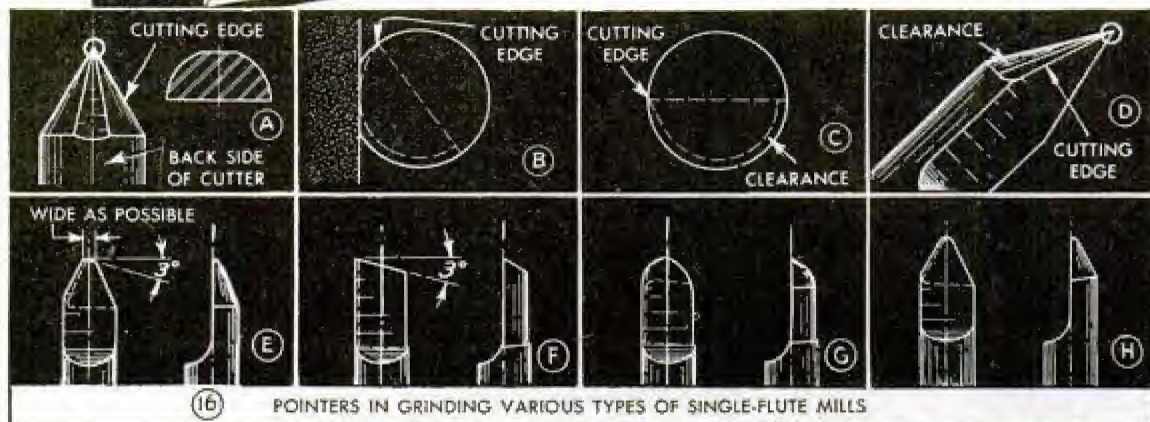


Fig. 15. The sunken V-groove type is used to engrave reading matter on labels, plates, instruments and tools, also to cut sunken lettering in dies and molds. Different widths of face are produced by varying the width of the cutter used, or by varying the depth of the cut. Sunken square-bottom type is used to produce sunken lettering where square corners are required, while relief or raised type is used to produce relief characters on dies, molds and stamps.

Most copy type is made from engravers' brass because it can be machined readily, yet is quite resistant to wear. However, copy type sometimes is made from harder metals, especially where used on large quantity production.

Grinding single-flute mills: A duplicator or pantograph operator is not likely to sharpen his own cutters, but the regular tool grinder hand will appreciate the following suggestions: On single-flute mills, grinding is different than it is



POINTERS IN GRINDING VARIOUS TYPES OF SINGLE-FLUTE MILLS

with the conventional type of end mills. The flat must be on perfect center and the angle of the conical cutter varies from 45 to 60 degrees (combined angles) depending on the nature of the cut. The point and flat should be ground on the side of the wheel after dressing with a diamond tool. The point is ground first, which is done like grinding a lathe center, and then the flat is surfaced to return it on center. The next step is to grind a flat as shown in detail A of Fig. 16. Starting from the cutting edge and gradually feeding the wheel in, the cutter is rotated by hand to remove the material back of the cutting edge as in details B and C, with results as shown in detail D. When a sharp point is not required, the cutter is "tipped off" as in E. Square-nose cutter, F, is given a straight peripheral clearance similar to the conical mill, and then a suitable rake angle is ground on the end. Ball-nose cut-



ter, G, is ground quite the same, but in this case a wheel dressed to proper radius is used to relieve the circular point. Some conical mills are finished to ball-nose style as in H. Other conical mills are ground three- or four-sided, thus providing a number of cutting edges, frequently used to cut steel stamps.

Improvised Brake for Wheelbarrow Used on Steep Ramps

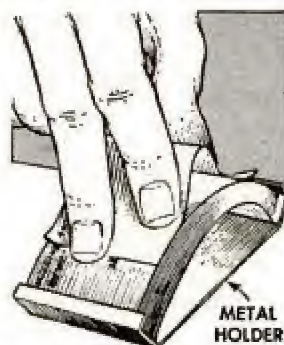
On a construction job where loaded wheelbarrows had to be pushed up a long, steep ramp, simple brakes were improvised from strips of belting to hold the barrows if the men had to stop while on the ramp. As shown in the circular detail, a strip of belting was riveted to the underside of

each wheelbarrow so that the lower end dragged on the ground when the barrow was being pushed, but when the barrow was rolled back a foot or so, the wheel would roll onto the strip, which then kept the wheel from turning. With this arrangement, the brakes took effect automatically, causing no loss of time or labor for the workman.



Labels Removed One at a Time From This Handy Holder

To hold loose labels so that they will not be scattered about in a drawer, and yet be easy to remove one at a time, use a holder like the one shown. It is made from a piece of sheet metal bent to the shape shown so that when a stack of labels is placed in it the stack will be bowed up in the center, thus permitting the labels to be slipped off easily with the fingers.



Concave Surfaces Turned Easily In a Lathe With This Tool

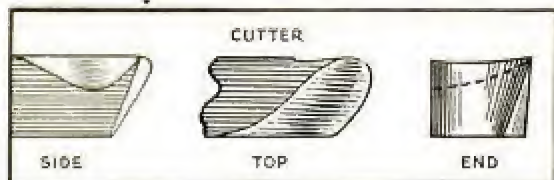


Turning concave surfaces in a lathe is no problem if this adjustable tool is used to guide the tool bit. The tool consists of a length of small pipe and a length of rod having an eye welded to one end to fit over the lathe toolpost. The rod telescopes inside the pipe where it is held by two thumb screws, which permit length adjustment of the tool. In use, the eye of the tool is slipped over the toolpost and the other end is placed against the tailstock center. Then, as the cutting bit is fed into the work by means of the lathe cross slide, the carriage will have to be moved slowly and carefully forward to keep the tool snugly against the tailstock center. This action tends to move the cutting bit slowly forward as it is moved across the work with the cross slide, thus causing the bit to cut a concave surface.

—R. E. Rosendahl, Muskegon, Mich.

Hints on Machining Cast Iron

When turning, milling or shaping cast iron, one machinist finds the following hints very helpful: Use the deepest possible cut, from $\frac{1}{16}$ to $\frac{3}{8}$ in., depending on the size of the machine, and run the machine at its slowest possible speed. Feed the cutter as fast as possible without it chattering or stopping the machine. In addition to this, bring the roughing cuts to within



.0005 to .0010 in. of the finished dimensions. The shallower the final cut the better your finish. You will find that a cutter ground to the shape shown gives very good results with little or no chattering and speeds up production and improves the quality of the work. Machine cast iron dry without a coolant, lubricant or cutting compound.

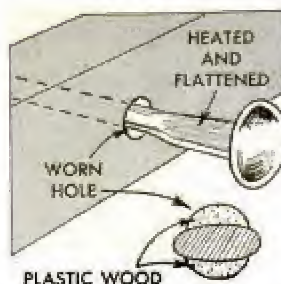
Magnet Aids in Riveting Pipe Made of Sheet Metal

The difficulty of holding a rivet in a sheet-metal pipe or tube while placing it on an anvil for peening the rivet can be avoided by using a magnet to hold the rivet as shown. After putting the rivet in place, just place the magnet over its end. Of course, this method will work only on iron or steel rivets as those made of copper or brass are not attracted by a magnet.

—Chas. S. Marshall, Baptistown, N. J.



Squared Bolt Stays in Place When End Is Flattened



Carriage bolts will not turn in holes that have worn too large for them if the head is heated and the square portion flattened as shown. Driven into the hole, the altered bolt stays firmly in place. Plastic wood will fill any holes or gaps around the bolt.

—W. F. Schaphorst, Newark, N. J.

Chipping of Upholstery Tacks Avoided by Tape on Hammer

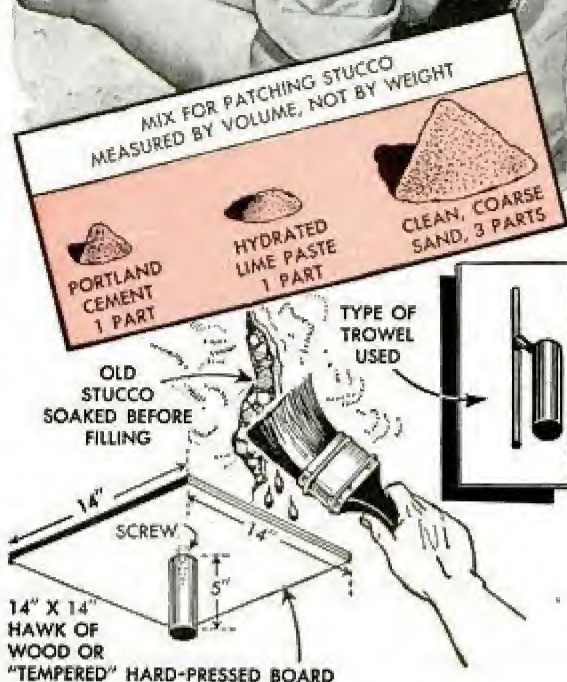
Paint on the heads of upholstery tacks often chips off when driving them if a steel hammer is used. To avoid this, one upholsterer puts a piece of adhesive tape over the end of the hammer.



Repair cracked STUCCO before painting



ANYONE can patch cracked stucco, which should be repaired as soon as possible. Cracks not only mar the appearance of the building, but also permit the entrance of moisture, which damages the structure underneath. First, with a hammer and chisel, cut away all the loose, crumbling pieces from the cracks and holes, after which the edges of the holes and larger cracks are undercut or beveled toward the bottom of the opening to help anchor the new stucco in place. Next, mix the patching material as indicated above, using a box and hoe if a large amount is required. Lime paste in the formula is powdered, hydrated lime mixed with water to a soft, thick paste, the lime being given all the water it will soak up but no more. Since it is almost impossible to match colored stucco because of fading and staining by the weather, it is best to avoid coloring the patching mixture. Painting the building after repairs have been made is best. However, if you want to try coloring, add mortar or lime-proof dry colors in place of some of the lime in the mixture, first mixing the color to a soft paste with water. After mixing the patching material, thoroughly soak the edges of the cracks and holes with water applied with a brush. Patching is done with a rectangular trowel. A hawk like the one shown in the lower detail is handy for carrying the plaster. For a sand finish, the trowel is covered with carpet. Deep holes and cracks are best patched in two coats. The first one is smoothed off at a point about $\frac{1}{2}$ in. from the finished surface and then is scratched to give the second coat a tooth. Let the first coat dry and shrink overnight and



wet it before putting on the finish coat. Cracks too fine to fill with stucco can be filled with the first coat of paint. Brick and stucco paints are formulated for good adhesion and sealing of the surface with the first coat. The first coat should be brushed over the fine cracks two or three times before painting the wall. Cracks too small for filling with stucco and too large to fill with paint are best filled with calking compound.

—F. N. Vanderwalker, Flossmoor, Ill.

Ⓐ piece of adhesive tape wrapped around a smooth-surface screw cap of a bottle provides a good grip for unscrewing the cap.

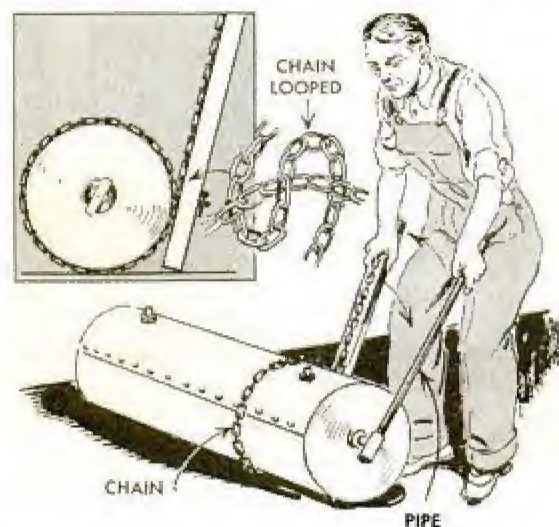
Carpet Aids in Removing Baskets From Grocery Delivery Truck



One groceryman who had his truck divided into three tiers for delivery baskets simplified the problem of removing the baskets from the upper tiers by setting them on strips of carpet. In this way, the truck driver could bring the baskets into reach from the ground merely by pulling forward on the carpet strips.

'Pipe Wrench' to Remove Fittings On Discarded Hot-Water Tanks

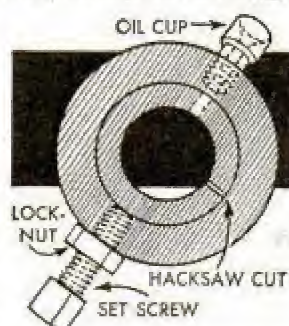
Having a number of discarded hot-water tanks from which to remove the fittings, one mechanic rigged up this chain wrench to grip the tanks for unscrewing the fit-



tings. The wrench consists of a length of wood and a chain, one end of the latter being attached to the wood strip by means of an eye bolt. In use, the chain is given one turn around the tank and then looped over itself as indicated. In this position, pressure on the end of the wood strip causes the chain to grip the tank tightly, the greater the pressure the tighter the chain grips to keep the tank from turning while the fitting is unscrewed either with a pipe wrench or by means of a length of pipe turned into it to serve as a handle as indicated.—A. L. Mills, Chicago.

Tightening Worn Motor Bearings

When plain bearings on a small electric motor are worn and new ones are unavailable, the worn ones can be tightened for further service as shown. First, remove the bearings and slit them



along one side with a hack saw and remove all burrs. Then drill and tap each bearing on the underside for a $\frac{1}{4}$ -in. setscrew. Replace the bearings with their slitted sides at right angles to the positions of the setscrews as indicated. Now, using setscrews fitted with locknuts, tighten them against the bearings until the motor shaft runs snugly but freely and set the locknuts. The bearings can be readjusted easily at any time.

—Paul St. Gaudens, Coconut Grove, Fla.

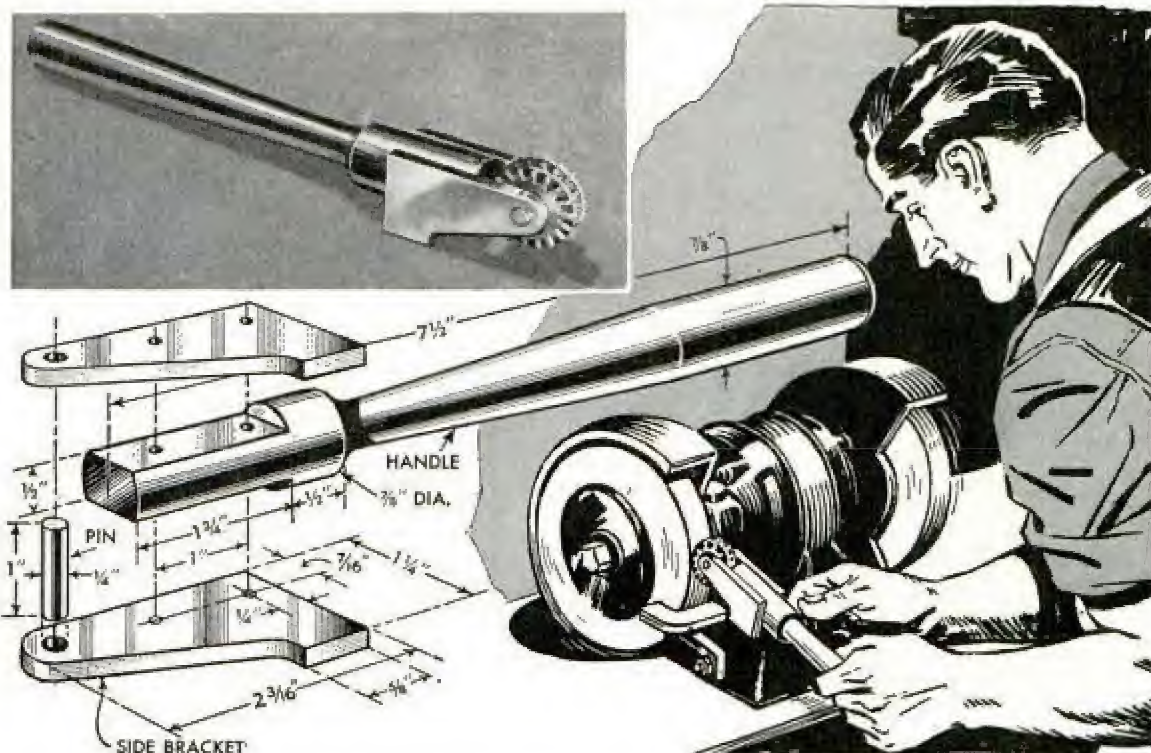
Wire Holder Retains Thin Paper In Portable Typewriter

If thin paper tends to fold forward and obstruct your vision when typing, especially when making carbon copies on onion-skin paper, and there is no holder to prevent this trouble, you can make one for the purpose. Just bend a piece of light wire to the shape shown and insert it into the curved lip of the paper rest, or push it beneath the paper guide. The holder will not damage the typewriter and can be removed when not in use.



—John K. Karlovic, Chicago.

Make Your Own Grinding-Wheel Dressing Tool



Anyone who has access to a metal-turning lathe can make this grinding-wheel dressing tool. However, it is best to purchase the hardened cutters, which are quite inexpensive. The tapered handle is turned by adjusting the compound rest at a slight angle and making the cut as long as the compound will allow. The balance of the cut can be made straight with the

carriage feed. The two side pieces that retain the cutter are cut in a shaper, after which they are clamped temporarily to the handle, drilled and slightly countersunk for flush riveting. Then the completed parts are riveted together. The cutters are mounted in the holder on a drill-rod shaft, which is a drive fit in the holder, but a loose fit in the cutters so they can rotate freely.

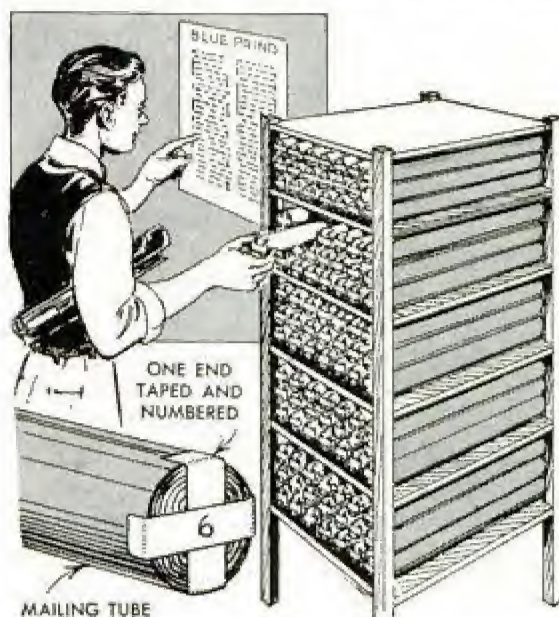
It's Easy to Locate and Remove Blueprint From This File

In a large concern where a number of blueprints had to be referred to often, they were filed for quick and easy selection as shown. Each print was inserted inside a mailing tube, one end of which was left open for removal of the print, the other end being closed with two strips of gummed-paper tape and numbered. An index listing the prints and their numbers alphabetically was kept nearby so that any print and its number could be located instantly, the tubes being filed numerically in the cabinet.

Wire Brush Removes Bean Stalks

Removing the dead vines of Kentucky Wonder and other climbing beans from fences can be done easily if a wire brush is used for the job. The type of brush used by painters in scraping off old paint is ideal.

—W. F. Heisterman, Clarendon Hills, Ill.



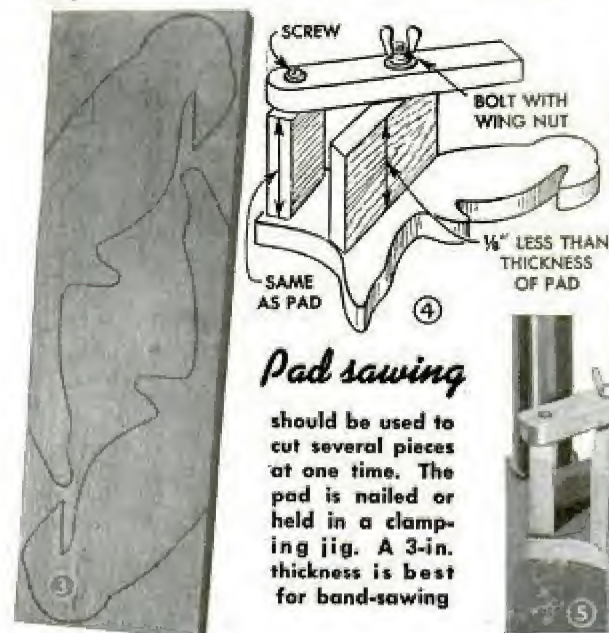


More SPEED on CUTOUTS

by Sam Brown

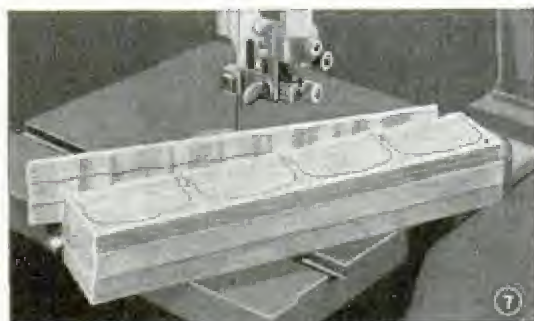
IN PRODUCING novelty cutouts for profit, the owner of a small shop must make every possible use of production methods in order to turn out work that can be sold at competitive prices.

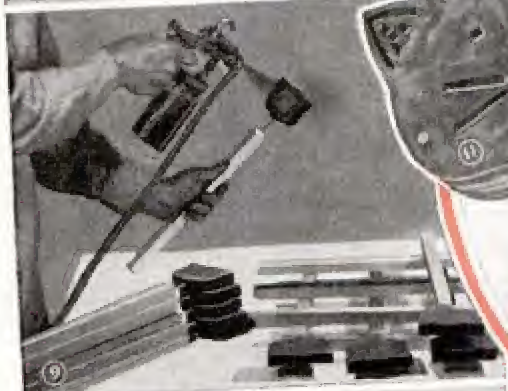
Pad sawing: This is a popular method of producing several figures at one time by the familiar method of making a pad of the work. Band-saw work should be about 3 in. thick, and scrollsaw about 1½ in. Even where the machine has greater capacity, there is little to gain in exceeding these thicknesses. Simplest method of assembling the pad is by nailing, locating the nails in the portions of the work that will be waste stock as in Fig. 7. Two or more figures on a panel as in Fig. 3 often saves lumber, and in all cases eliminates some cutting of the original blank. For long-run work, many operators prefer to use holding jigs. The box jig in Figs. 1 and 2 is ideal for work that has at least one uncut square corner. The clamp jig, Figs. 4 and 6 can be used for any figure having one uncut edge. In making jigs of this kind, the base block is left in-the-square, being cut to shape at the same time as the



Pad sawing

should be used to cut several pieces at one time. The pad is nailed or held in a clamping jig. A 3-in. thickness is best for band-sawing





Block printing

with linoleum or wood block is an excellent method of marking black detail lines. Transfer can be made by hammering or by pressure

first load of panels. Turning holes, Fig. 5, are very helpful. A check should be made to see that both drill and band-saw blade are aligned square before starting work.

Block printing: Photos in Figs. 8 to 13 inclusive picture good production methods of finishing cutouts by dip-staining of edges and block printing of detail. Fig. 8 shows the initial operation after band-sawing, the work being dipped into water stain of the same color as the paint to be used on the faces of figures. The purpose of staining is to color the edges, after which the work is face-sanded to remove any raised fibers in preparation for spray application of lacquer on the face, Fig. 9. Note the use of square sticks with fine-pointed nails as a means of holding the cutout. This is one of the simplest and best methods of handling all types of small cutouts. Black detail on the face of the figure is put in with a linoleum or wood block. The design can be transferred by hammering as in Fig. 12 if the figure is small, otherwise some simple form of pressure such as a clamp or vise should be used.

The inking pad is a piece of 1/8-in. felt glued to a wood block. Regular block-printing ink is ideal for maximum blackness but is very slow drying. Colors in japan give slightly fainter impressions but are fast-drying and quite satisfactory. In either case, the color is used just as it comes from the tube, being rolled out on the pad with a roller or stick. Fig. 13





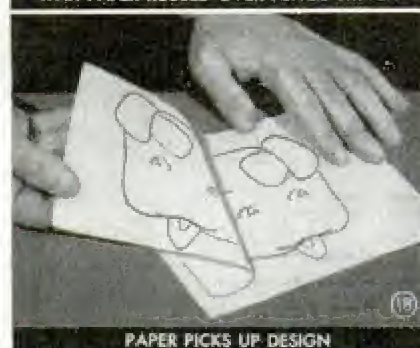
The perforated pattern

is ideal for transferring outline or pattern for hand painting. Best medium for the pattern is celluloid obtained from old photo negatives. The paint should be thick color in japan, applied sparingly

shows the finished cutout, painted thumbtacks being used for eyes. The body of the figure is not a cutout, strictly speaking, but is formed with the use of a pattern on the shaper. Note again the use of stain as a means of coloring the edges of the cat's face. This method is fast and clean, and can be used to advantage on any type of cutout. The slight grain raising of water stain is not objectionable since it helps to conceal band-saw marks, but non-grain-raising stain can be used if desired.

Perforated patterns: The perforated pattern is an excellent method of transferring designs for hand painting. Best material for the pattern is thin celluloid such as old photograph negatives. The original pencil drawing of the design is rubber-cemented to the celluloid, after which the design is perforated by drilling with a $\frac{1}{32}$ to $\frac{1}{16}$ -in. drill as in Fig. 15. The finished pattern is shown in Fig. 16. In use, the pattern is held firmly against the work while color is applied by means of a toothbrush, as indicated in Fig. 14. Use colors in japan at tube thickness and keep the brush almost dry. Do not attempt to use any type of paint or ink that is the least bit fluid. Advantages of this method are that the pattern need not be cleaned and can be used continuously for as many times as desired, it can be turned over if opposite side of cutout is to be painted, and the design takes equally well on coated or bare wood panels.

Waxed-paper transfers: This is a good method of transferring the design for short-run work. The paper used can be made by brush-coating with hot paraffin wax, but is best purchased as it is inexpensive. This paper is not the familiar waxed wrapping paper, but is a special product made for transferring designs. A pencil sketch is made first, using a soft lead pencil. The wax paper is rubbed over this, Fig. 17, and then is stripped off as in Fig. 18. Rubbing the waxed paper over the work, Fig. 19, completes the transfer. This method gives eight to ten clean impressions on smooth coated stock. The design takes poorly on bare wood, hence painting of the panels before cutting is essential.

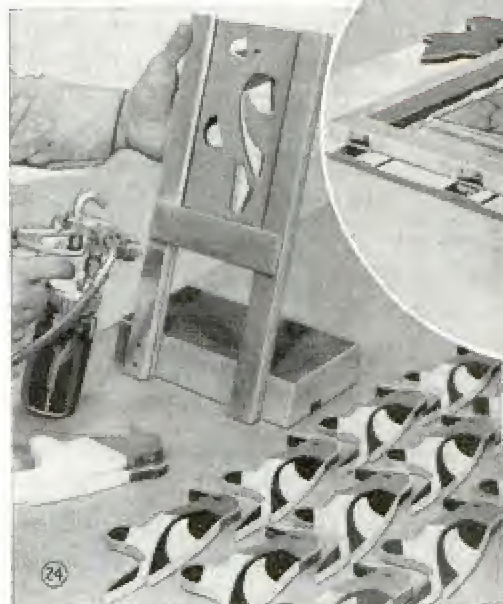
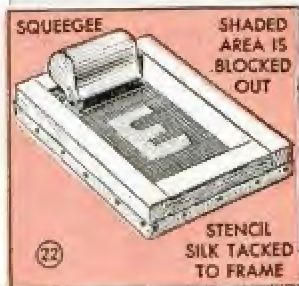


Wax-paper transfers

are used for transferring designs. The paper lifts the design from a pencil sketch and is then rubbed onto work

Hand painting: Many cutout designs consist only of a solid base color with black lines for detail. On short-run work it is advantageous to freehand the detail. Transfer methods previously described can be used for guide lines, and the painting medium should be colors in oil or japan.

Silk-screen stencils: Best of all production methods of painting is the silk screen stencil. This method is described fully in the 1940 issue of Popular Mechanics Shop Notes. Briefly, the stencil material is a silk cloth,



Silk-screen stencils

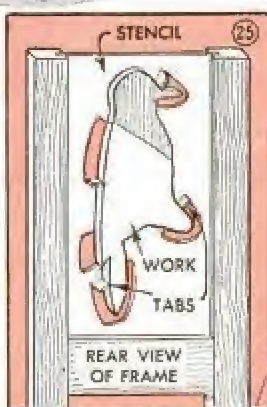
offer the best production method of painting. Sample illustrated shows paint-filled screen

and the stencil is blocked off to leave a black margin around the cutout. The silk screen method allows many manipulations, multiple color work, photographic screens, etc. Every serious worker in cutouts should give this method a trial.

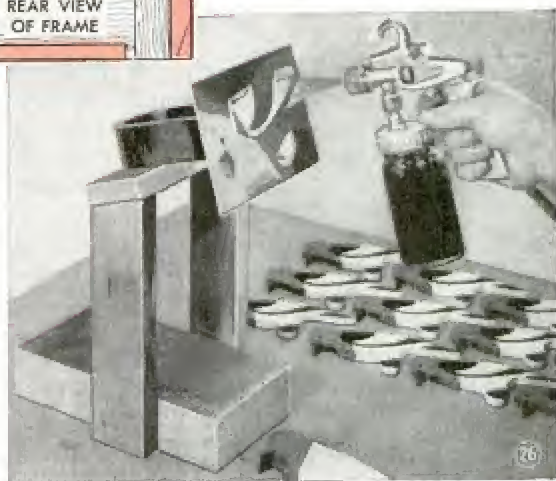
Metal stencils: Metal stencils are widely used on both short and long runs. The stencil can be made from tin, brass, zinc or other metal about .012 in. thick (28-gage). Cutting of the stencil is done

Metal stencils

can be cut out on the scrollsaw and are excellent for general work. Magnet method of holding shown at right is used extensively in industrial painting of cutouts



running about 140-mesh per inch. The silk is tacked drum tight on a wooden frame, and the areas which are not to print are blocked out with a special filler. Fig. 22 pictures the set-up for stenciling the letter "E," the area around the letter being blocked out. Paint is poured on the screen and wiped from one end to the other by means of a rubber squeegee. The action of the squeegee forces paint through the silk and thus transfers the design. A typical set-up with silk screen stencil is shown in Fig. 23. The edges and face of work are first painted black, as in Figs. 20 and 21,

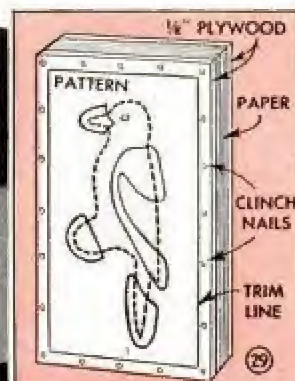




on a scrollsaw, with the metal held between plywood sheets. It is preferable to have two or more stencils of the same figure. Simplest working method is a wooden frame into which the stencil fits, Fig. 24, the work being held by hand behind the stencil, which will run seven or eight pieces before the paint starts to pile up. The dirty stencil then is thrown into a pan of lacquer thinner, and the second stencil is picked out of the thinner, brushed off and blown dry ready for use. One of the neatest methods of holding the metal stencil is shown in Fig. 26 and employs a magnet. The wood cutout is placed against the magnet and is topped by the stencil. The magnet then holds everything in place for painting. Any ordinary magnet of fair size will hold small cutouts of $\frac{1}{4}$ -in. plywood. For larger or thicker work, several magnets can be grouped together. "Magnetic chucks" of this kind, both plain and electro, can be purchased in any size and have the advantage of increased power plus off-on switch control. Whatever method is used, the metal stencil should have tabs or other locating device to position the work, Fig. 25. Obviously, if the magnet method is used, the stencil must be tin, iron or steel and not brass, copper or zinc.

Paper stencils: Plain paper stencils in several variations have many uses in cut-out painting. If paper stencils are used, it is advantageous to cut fifty or more stencils at one time by clinch-nailing the paper sheets between plywood as in Fig. 29. Tightly nailed and cut on the scrollsaw, edges will be sharp and clean. Used stencils are thrown away when dirty. The principal disadvantage of the paper stencil is the difficulty encountered in getting it to lie flat on the work. Unless firmly held, the spray gun blast will blow under the edges of the stencil. This can be minimized by using a round spray, reducing air pressure

to minimum, and directing gun at right angles to the work at all times. "Blow-unders" can be eliminated entirely by using some method to actually "glue" the stencil to the work. The wax paper previously mentioned is fairly good; plain paper with dabs of wax, rubber cement or other sticky substance often can be used, or the stencil can often be held down by small weights or pins. Best of all is duplex stencil paper. This is a rubber-coated pa-



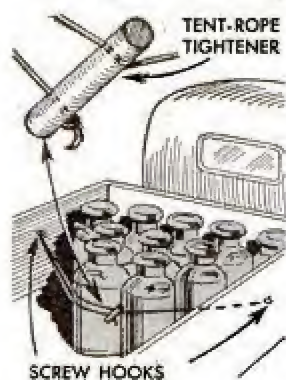
Gummed-paper stencils

provide perfect adhesion to the work and are excellent for use on long- or short-run jobs

per with strip-off backing. To use the stencil, simply strip off the backing and roll the stencil onto the work, as shown in Fig. 30. This paper has an advantage in that it leaves no deposit whatever on the work. The same stencil can be used for several pieces of work. The complete painting schedule for the figure used to illustrate stenciling methods is shown in Figs. 27 and 28. The work is first sprayed with white undercoat and then white lacquer enamel, after which the head of the figure is painted red by dipping, Fig. 28, using a synthetic to avoid stripping the lacquer undercoat. The work is now ready for the black detail, using any of the stencil methods described. If both sides of the figure are to be painted by using gummed stencils, one half of the pad should be turned over when cutting so that the cement will be on the proper side when the stencil is reversed.

Woods to use: On all cutout work avoid fir, cypress, hemlock, yellow pine or any wood with alternate soft and hard grain. Such woods "washboard" badly in band-sawing and have a poor face grain for painting. Excellent cutout woods include poplar, white pine and basswood, poplar being the best and also inexpensive, using fifth grade material (stained saps) which is quite satisfactory for paint. Plywood is excellent for all figures. Unselected red gum is a much better wood for painting, both edge and face, than commonly used fir. If plywood figures are to be used outdoors, the plywood must be the waterproof variety. Plywood panels already coated can be obtained and often show an actual savings in paint costs.

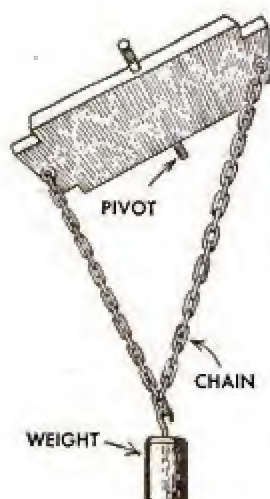
Milk Cans Held Snugly in Truck By Tent-Rope Tightener



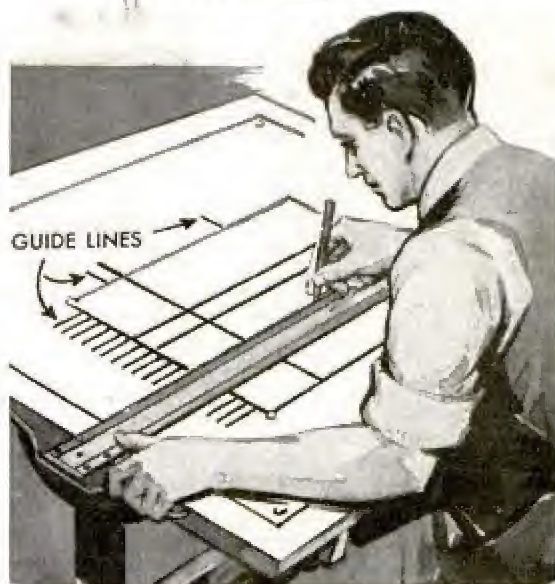
To keep milk cans from sliding around in his truck, one milk collector uses a strong rope with a tightener of the type used on tent ropes. The rope is attached to the sides of the truck and is adjusted easily to hold a few or many cans.

Trapdoor in Ventilator Weighted For Easy Adjustment

Pivoted trap doors used on many poultry-house ventilators may be made readily adjustable if a weight is suspended from a chain as shown. The angle at which the trap door tilts depends on the point at which the weight is hung on the chain.



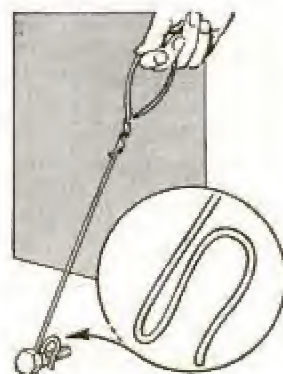
Ruled Forms Are Made Speedily On Drafting Board



When some experimental ruled forms are necessary to try out before ordering quantities from a printer, a small supply can be ruled rapidly with a T-square and a drafting board. Guide lines are measured accurately on the sheet used as backing, squaring off the exact spot where the ruled form will be tacked on the board. The tacks need not pierce the ruled form but may be placed at the corners to hold the paper firmly in place. With the T-square moved along guide lines, rulings can be effected rapidly. Horizontal and vertical lines may be carried only to points desired, either in pencil or ink.

Small Articles Retrieved Easily From Hard-to-Reach Places

Bent as shown, a length of fairly heavy wire provides a handy retriever for nuts, bolts, screws and other small parts that have fallen into places that cannot be reached with the fingers. The retriever is especially handy for "fishing" nuts and bolts that have been accidentally dropped into clutch and transmission housings, etc. Just enough tension should be allowed in the curve of the wire prong to snap over a nut or bolt and hold it until it is lifted enough to be reached with the hand.—Chas. H. Hardy, Los Angeles, Cal.



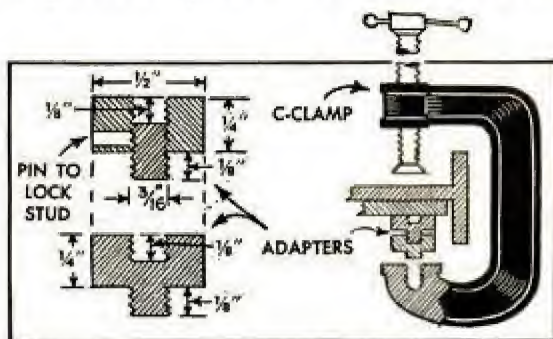
Turntable Chart Holder on Bench Permits Quick Selection



Reference to various charts in one garage was simplified by keeping them on a holder that could be rotated. The holder consists of a square box pivoted to the workbench, the pivot consisting of two pipe flanges and nipples assembled as shown. The charts were divided into four groups and attached to the four sides of the box by means of rings as indicated. With this arrangement, the holder could be rotated to bring any group of charts to the front, after which the desired chart could be found quickly.

Removable Jaws for C-Clamps

In my work as an aircraft assembly mechanic I found an ordinary C-clamp often inadequate in holding the various T- and I-shaped pieces together for drilling. To improve the clamp for this work I made up a number of variously shaped jaws that could be screwed into the lower jaw of the clamp as indicated. While the size and shapes of the jaws shown were suitable to

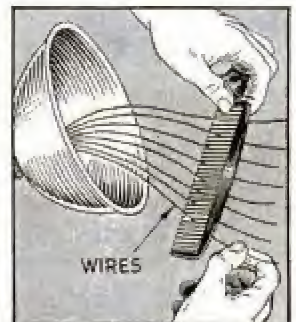


my particular work, they could be made to other sizes and shapes required.

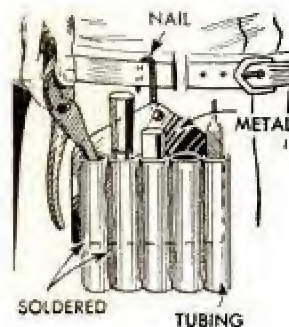
—Paul McLaughlin, Richmond Hill, N. Y.

Wire of Electrical Fixtures Held In Order by Pocket Comb

The difficulty of holding several wires of some electrical fixtures separated and paired for soldering led one electrician to use his pocket comb as shown. The fine wires are merely pulled between the teeth of the comb, and then arranged in their proper order.



Small Tool Holder to Carry On Your Belt



You will find this holder more convenient than the usual leather one. It always hangs vertically regardless of the position of the worker, thus preventing the tools from falling out, and the pockets are always open

for quick insertion or removal of the tools. Besides these advantages, there is no possibility of two or three tools coming out when you remove one of them. The holder consists of several short pieces of thin tubing soldered together on a backing of light sheet metal. A hook for attaching the holder to your belt can be made from a nail or piece of wire.—G. Peterson, Miami, Fla.

Modeling Clay Makes Emergency Caps on Tubes of Ink

When printing inks are purchased in tubes, the caps often become lost or mislaid. To avoid drying of the ink when this happens, one shop manager uses small wads of modeling clay which are pressed over the tube ends.





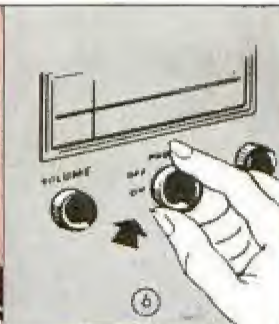
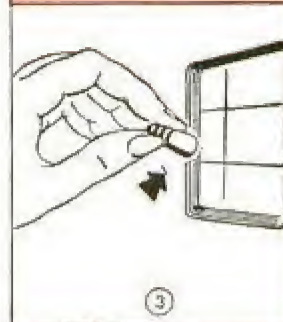
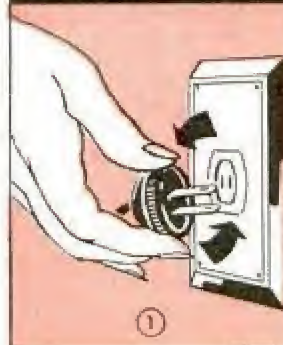
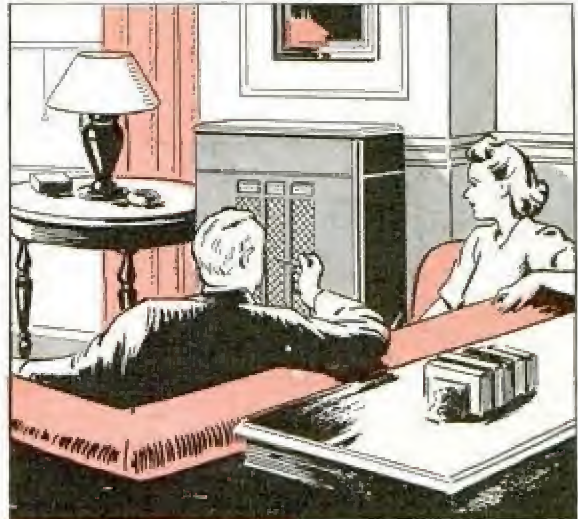
Radio

Home Check-Ups Save Service Calls

"**H**ELP your radio serviceman conserve his time and save the expense of unnecessary service calls" say busy radio manufacturers in a publicity drive to aid civilian radio repair men who are making every effort to do a 100 percent wartime job on home sets.

Here are a few simple checks that any radio owner can make for himself before calling a serviceman. If there is a hum in your set, try reversing the plug in the wall socket as indicated in Fig. 1. One way will usually be quieter than the other. Wires may become loose in the line cord plug. With ordinary plugs the wires are easily connected with a screwdriver as shown in Fig. 2; molded plugs are inexpensively replaced.

If the dial fails to light up, only the pilot light may be burned out, and this can be easily replaced. First disconnect the line cord from the wall socket; remove the bulb as in Fig. 3 and replace it with a new one of the same type. Most a.c.-d.c. radios need the pilot light in the circuit. Fig. 4: if the program is suddenly cut off, tune to another station, as the original station may be having trouble. Fig. 5 shows what happens when "permanent" type phono needles have been dropped on a record. Fig. 6: on a radio-phonograph if the switch is on "phono" you will not be able to tune in radio. Figs. 7 and 8 show types of receivers that have built-in directional loop antenna. If the set is noisy, weak or fades, turn entire set if a table model or adjust the rotary antenna unit as in Fig. 8.



"WIRELESS" CODE OSCILLATOR

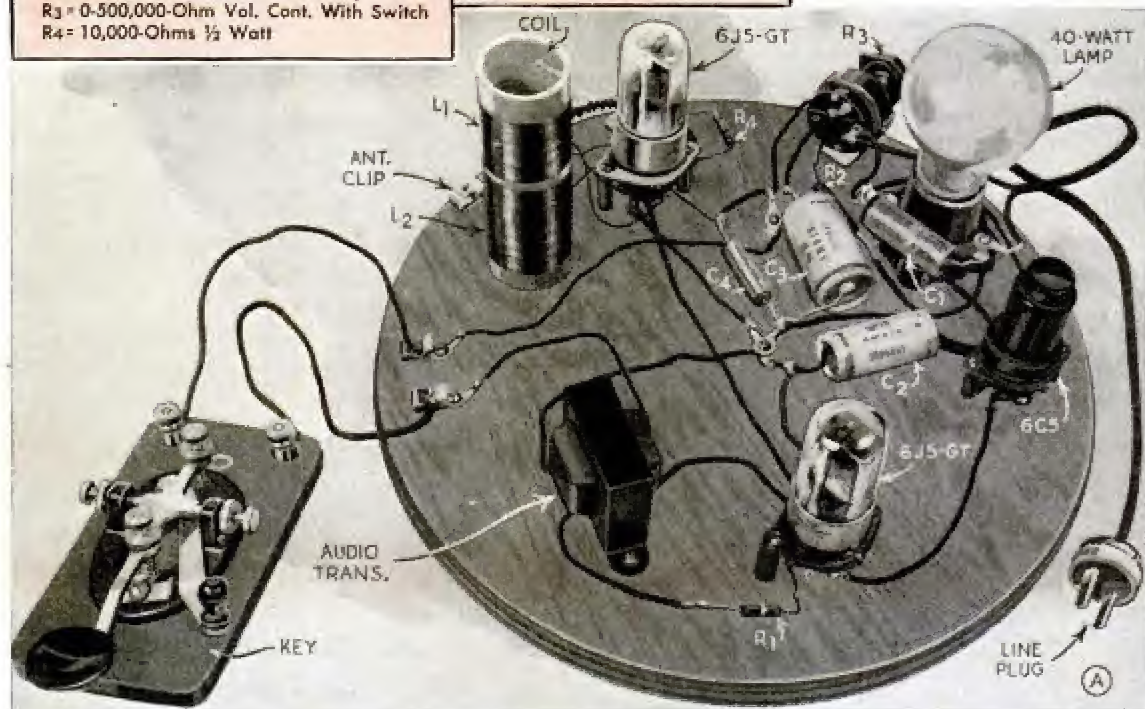
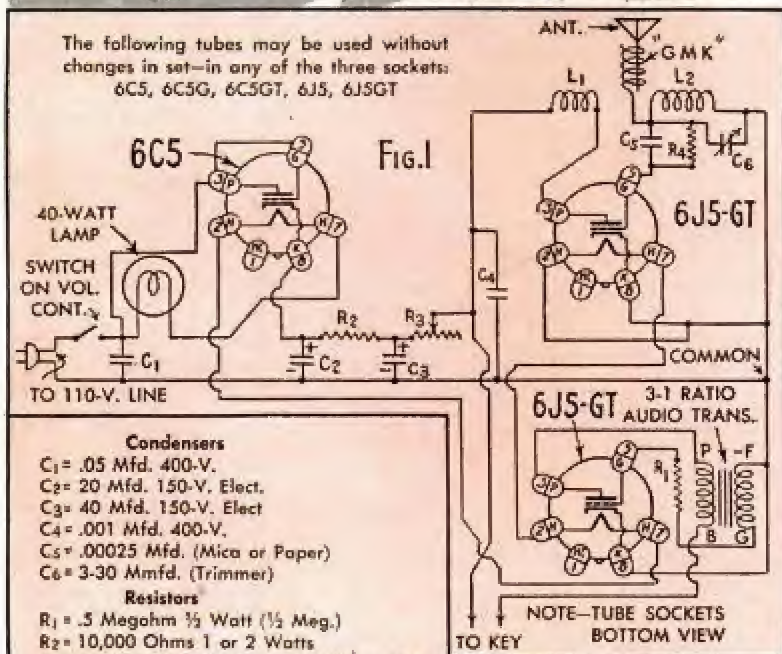


By S. A. Johnson

AS MOST radio code oscillators are designed for use with headphones, one of the problems of large code-practice groups is the inability to obtain headphones in quantity. Pre-induction code-practice sessions are well attended, therefore this a.c.-d.c. code oscillator provides a practical solution by supplying a clear-toned signal, easily keyed, which can be tuned in and amplified to full room volume by any good radio receiver.

If the receiver has a loop antenna, no connection between it and the oscillator will be necessary providing the two are not more than a few feet apart. With older types of sets, a wire should be run between the "antenna" clip on the oscillator unit and the antenna post on the radio receiver.

The following tubes may be used without changes in set—in any of the three sockets:
6C5, 6C5G, 6C5GT, 6J5, 6J5GT

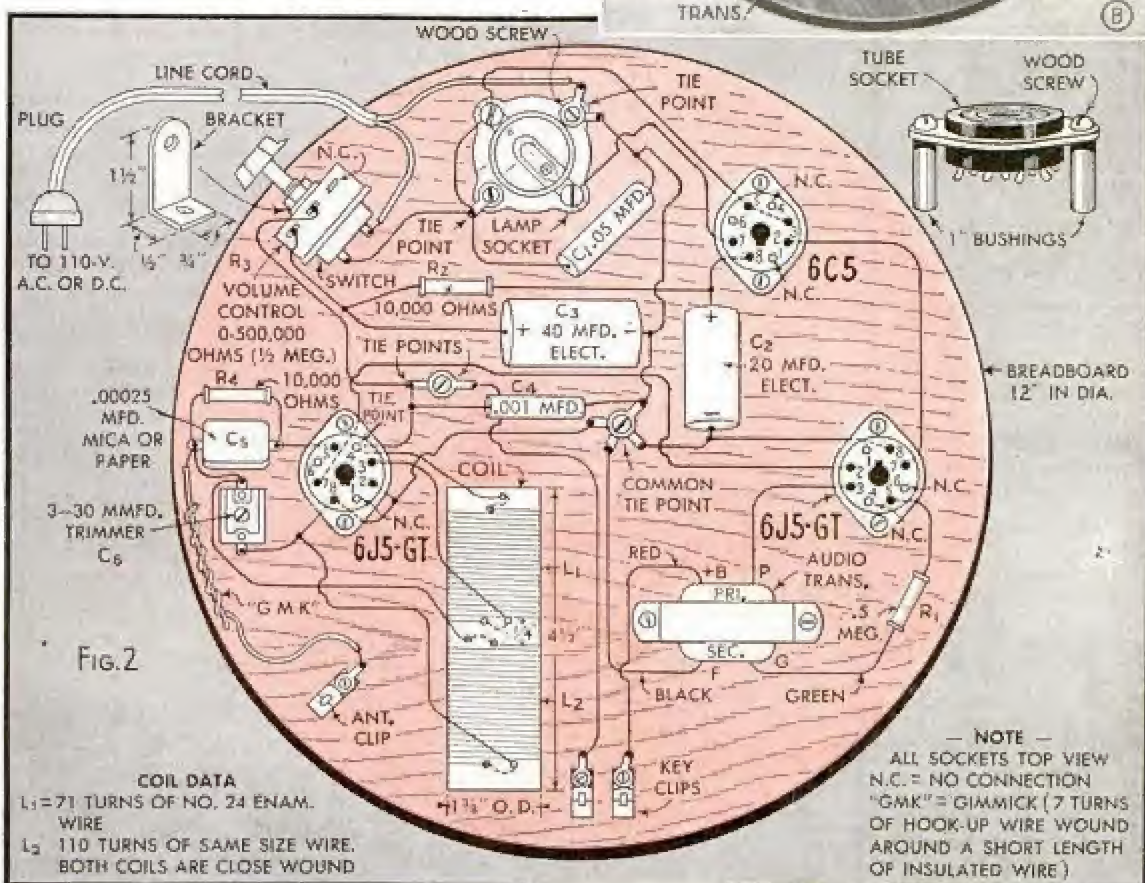


OPERATES THROUGH RECEIVER

SERVES LARGE GROUPS WITHOUT HEADPHONES

The circuit consists of an Armstrong oscillator modulated by an audio oscillator, and employs a simple half-wave rectifier. Shown schematically in Fig. 1 and pictorially in Fig. 2, the construction details are carefully given. All parts required were salvaged from old radios; the filter condenser values are not critical. A 40-watt lamp substitutes for a linecord resistor, and a wide variety of common tubes may be used. Assembly is made on a circular breadboard as shown in photos A and B. Detailed student material list R-325 is available from Popular Mechanics radio department upon receipt of postage.

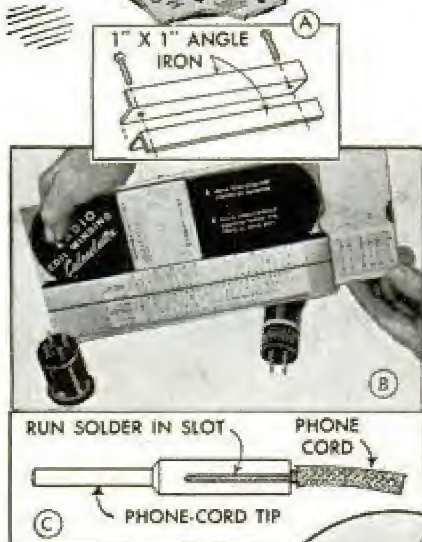
To operate the unit, test with a pair of headphones connected to the "key" clips, and adjust the variable resistor (R_3) for a pleasing tone. Then connect the key and adjust the trimmer condenser to about half capacity. Now tune in the signal on the radio set somewhere between 1,300 and 1,500 kc. and adjust trimmer so that the signals come in at a "quiet" spot.



Helpful RADIO SUGGESTIONS

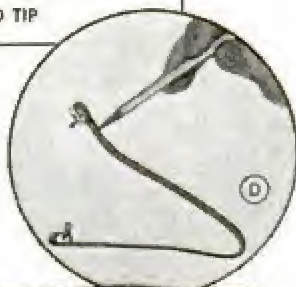


(A) Two lengths of 1 in. by 1 in. angle iron, clamped in a vise, substitute for a bench brake when sharp bends are required in thin sheet metal. Experimental chassis bases and emergency brackets of all types are accurately formed if the angle irons are drilled and threaded for bolts at each end as shown in the diagram. This pre-clamping of the material prevents slipping. When the assembly is clamped in the vise and backed with a piece of board, only a few taps with a hammer or mallet are required, as illustrated in the sketch

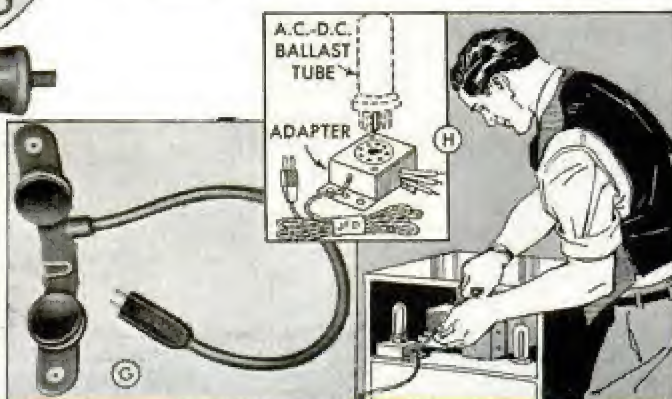
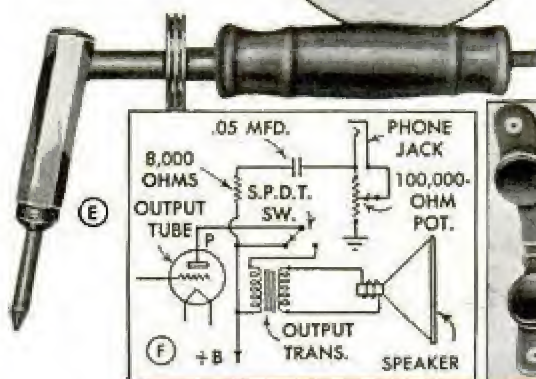


(B) Simplified slide-rule type rapid calculator provides the student and experimenter with a means for quickly determining the necessary data for winding single layer-wound solenoid RF coils. All values are found with a single setting of the slide and are accurate to within about 1 percent for coils ranging from $\frac{1}{2}$ in. to $5\frac{1}{2}$ in. in diameter and $\frac{1}{4}$ in. to 10 in. in length. All possible combinations within these limits are shown. (C) Time and patience saving phone cord tip repair. When the tip breaks off, apply the soldering iron to melt out the old stub and shake out the solder. Clamp in vise and slot the ferrule with a hacksaw. Carefully bare the delicate tinsel, or fine wire, in the cord for the new connection and insert as shown. Solder can then be run into the slot thus making a good mechanical and electrical connection. Any experimenter who has tried to repair a cord tip will appreciate this kink

(D) Loose clips on antenna lead-in strips are a common cause of poor reception; solder rivet and tape



(E) "Hatchet" or offset iron decreases operator fatigue in certain soldering jobs. (F) Hookup for interchangeable headphone or loudspeaker operation, in sets having single output tube. The fixed resistor is a 2-watt type; the blocking condenser is a 600-volt tubular paper variety. Potentiometer controls volume in the headphones. (G) Throat microphone for communication between aircraft pilot and crew leaves operator's hands free. (H) Adapter for replacing resistance line cords with available ballast tubes



HERE'S TO... *PERFECT*
3 ON A MATCH

COOLER,
 Milder,
 RICHER-
 TASTING!

SHE-YOU-AND
** PIPE APPEAL*

● Sure a man with a pipe "takes" a woman's eye. But follow through, friend...add true Pipe Appeal. Rise and shine with the personal pipe-joy of choice, bite-proofed Prince Albert. Mellow MILDNESS for your tongue... a revel of RICHNESS to your taste. Cool? It's cooler! Crimp cut, too...easy packing, easier drawing.

** PRINCE* 50 pipefuls of fragrant tobacco in every handy pocket package of Prince Albert
ALBERT 70 fine roll-your-own cigarettes in every handy pocket package of Prince Albert

THE NATIONAL JOY SMOKE

R. J. Reynolds Tobacco Co.
 Winston-Salem, N. C.

There's
been a
big change



RIDING side-saddle was conventional once—but it wasn't the logical way to stick on a horse.

Tyson found the logical way to get better service from a tapered roller bearing. They added 30% more rolls to the raceway... which automatically increased the life of the bearing.

But extra rolls mean more than extra life. Extra rolls mean a stronger, more rigid bearing . . . a bearing capable of sustaining greater loads with the highest efficiency.

* * *

The big name in bearings today is... TYSON!



TYSON BEARING CORPORATION, MASSILLON, OHIO

COUNT THE ROLLS - THE ROLLS COUNT



Tyson
TODAY'S HEAVY-DUTY BEARING

★ BUY MORE WAR BONDS ★

WHERE ARE THEY NOW?

This is an Elastic Stop Nut.

There are more of them on America's planes, tanks, guns, and naval vessels than all other self-locking nuts combined.

The reason is an Elastic Stop Nut holds fast and locks tight without any extra locking gadgets.

It does this because of the elastic collar in the top.

This collar squeezes between the bolt threads. It grips both sides of the threads. So no amount of vibration shakes the nut loose.

You can take the nut off and put it back on, time and time again, and it still retains its locking effectiveness. This is because the collar is elastic and "comes back."

Billions of Elastic Stop Nuts are in use. And as far as we know, not one in a million has ever failed.

After a while, with the war won, you will be able to have these nuts with the characteristic red collar on all the new equipment that will come. They will make it stronger, safer and more dependable just as they are doing on America's war goods today.



THE KIND OF JOB ELASTIC STOP NUTS ARE DOING

This is how the wing of a DC-3 transport plane is fastened on—with Elastic Stop Nuts, the nuts with the red collar so familiar to the aircraft industry. The tons of plane, crew and pay load depend on these nuts for their security. All told, this type of plane uses as many as 35,000 Elastic Stop Nuts.



ESNA

TRADE MARK OF

ELASTIC STOP NUT CORPORATION OF AMERICA

ELASTIC STOP NUTS

Lock fast to make things last

Union, New Jersey and Lincoln, Nebraska



BACK THE ATTACK
—BUY WAR BONDS

Floating Bridge to Tokyo

STEADILY the U. S. Navy is extending a steel span of ships across the Pacific. Defoe is building fleets of LCI (L) Landing Craft to provide the final link in this floating bridge to Tokyo. . . . It is a tradition among Defoe workers, men and women, to build battle-worthy strength into every ship they launch. They put heart as well as arm—brain, brawn and patriotic devotion into doing their job. . . . Because the way of the shipbuilder always is to build well, whatever this organization produces after the war will be enduringly good. Defoe's experience, spirit and teamwork have meant much to America's war effort and will result in better peacetime products and values for all Americans.

DEFOE SHIPBUILDING COMPANY,

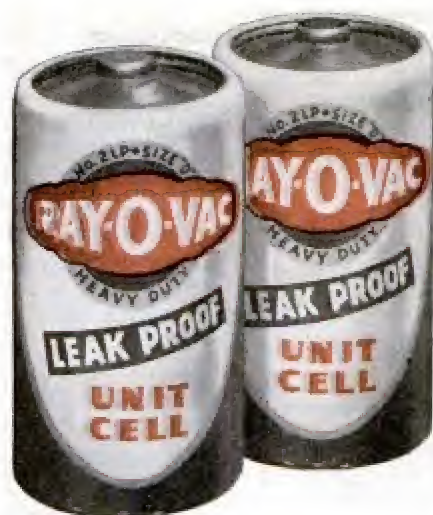
BAY CITY, MICHIGAN

Defoe



Three White Star Renewal Citations now decorate the Navy "E" Award won by Defoe workers.

SHIPS FOR VICTORY
SERVANTS FOR PEACE



Actual photo of
LEAKPROOF
BATTERIES
picked at random
from 1939
manufacture.

THESE FLASHLIGHT BATTERIES ARE **4 YEARS OLD - and STILL FRESH**

Remember when you picked up a flashlight, long unused, and found the batteries dead? The fact is, most flashlight batteries die just lying around...but not Ray-O-Vac LEAKPROOF Batteries. LEAKPROOF'S patented sealed-in-steel construction seals the power in...it's there when it's needed!

RAY-O-VAC LEAKPROOF BATTERIES ARE
NOW GOING 100% TO OUR ARMED FORCES



FLASHLIGHTS • BATTERIES

BUY WAR BONDS

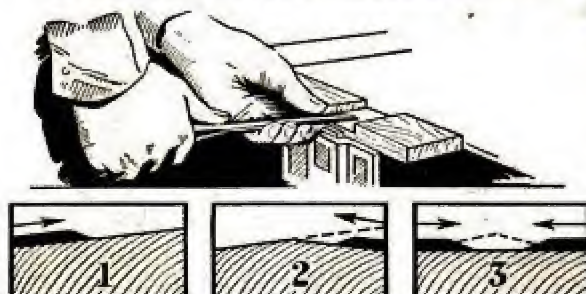


BUY WAR STAMPS

RAY-O-VAC COMPANY, MADISON 4, WISCONSIN
OTHER FACTORIES AT CLINTON, MASSACHUSETTS • LANCASTER, OHIO • SIOUX CITY, IOWA

Tool Tips by STANLEY

HORIZONTAL CHISELING

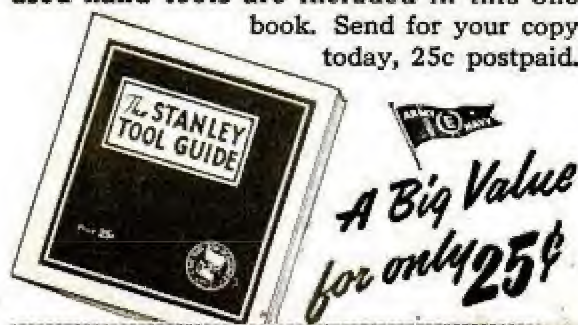


When cutting horizontally, *across the grain*, press the forefinger and thumb together on the chisel to act as a brake. To avoid splintering the corners, cut halfway from each edge toward the center. Remove the center stock last (see small sketches above).

To cut *with the grain*, the chisel is held slightly turned to one side to get a shearing action, and pushed away from the worker. For a roughing cut hold the bevel down, for a paring cut keep the bevel up.

Dozens of Proven Methods are Covered in the Stanley Tool Guide

More than 200 illustrations, with practical instructions covering the use of boring tools, doweling jig, spoke shaves, scrapers, planes, marking gauge, chisels, and other commonly-used hand tools are included in this one book. Send for your copy today, 25c postpaid.



STANLEY TOOLS

164 Elm St., New Britain, Conn.

Enclosed find 25c. Please send me the Stanley Tool Guide, postpaid. (In Canada: Send coin or stamps to Stanley Tool Co. of Canada, Roxton Pond, Quebec.)

Name.....
Address.....
City..... State.....

"Prepare for Ditching"

Continued from page 15

of Flying Safety at Winston-Salem, N. C., our flyers now have a pretty good chance to come back alive from a landing at sea.

Before every over-water mission, the pilot who wants to come home sees that ditching equipment is ready—life rafts and vests with carbon dioxide cartridges, ration kits and water, emergency hatches in good order, radio, signaling pistols, sea marker and sun mirrors ready.

When only five minutes' fuel supply remains, the pilot gives the order "Prepare for ditching." Crew members loosen shirts, remove neckties and heavy boots, jettison bombs, depth charges and loose equipment, secure lower hatches against the sea and prepare upper hatches for quick exit. The navigator gives the position to the radio operator, who relays it along with SOS calls until the last seconds, when he clamps down the key to transmit the SOS automatically. Each member, as he takes care of assigned equipment, reports on the interphone, and all take "crash positions" in the radio compartment. Doors are closed, parachute pads and cushions arranged to take up the shock of hitting the sea.

Five seconds before the impact, the pilot orders "Brace for ditching." The radio operator relays this word received over the interphone. There is a mild jolt as the tail strikes, then a severe shock as the nose bangs into the waves. The ball turret gunner pulls the two dinghy releases and the rafts inflate and pop out of the wings. The men, taking designated equipment, hit the exits in the order practiced.

Rafts are cast off and tied together. As long as the plane stays afloat the crew stays nearby, since the plane is easier to spot from the air.

Similar procedure has been outlined for the B-24, B-25, B-26 and A-20 planes, with variations dictated by the arrangement of crash positions and escape hatches. Posters and instructions issued by the Office of Flying Safety offer graphic lessons to be followed in "ground practice" at bases.

Horny-Handed Heroes

Continued from page 53

sailed for the battle area, and the Seabees stuck at their jobs. They were commended by Admiral William S. Halsey, Jr.

In another instance, Seabee truck drivers on a Navy vessel were able to take a direct poke at the enemy. Their trucks were lashed to the deck of a ship. Through-

Continued to page 152



MEET YOUR NEW NEIGHBOR . . .

Hallicrafters is the world's largest exclusive manufacturer of short wave radio communications equipment. • Today, Hallicrafters is engaged in war production only . . . the 1st exclusive radio manufacturer to receive the Army-Navy Production Award for the 3rd time. • Tomorrow, Hallicrafters will build YOUR radio!



BUY MORE BONDS!

Far away places and strange customs seem that way only because of the limitations of travel and communications. Just as the rapid development of air travel made the world smaller, so is radio breaking down the traditional barriers of languages and ways of life. In the postwar world, short wave radio will be of utmost importance to everyone. Hallicrafters will again be the name to look to for the most advanced developments in radio.

hallicrafters RADIO

THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.

JUNE, 1944

151

Avoid this winter's... Chilly Chats



INCREASE HOME COMFORT WITH BALSAM-WOOL ATTIC INSULATION



Don't go through it again! If your home was chilly last winter—if you couldn't seem to get comfortable—do something about it right NOW. Balsam-Wool Sealed Insulation, laid in your attic, will step up your comfort and step down your fuel bills—as much as 20%.

It's so simple—so easy—to apply Balsam-Wool. This famous sealed blanket-type insulation is laid in your attic just like a rug. Once applied, it is there to stay—windproof, moistureproofed, fire resistant. Remember, too, that Balsam-Wool has proved its lasting value in hundreds of thousands of homes.

A money-back guarantee protects you when you buy Balsam-Wool—the most complete guarantee ever offered by an insulation firm. See your lumber dealer about easy monthly payments on Balsam-Wool Attic Insulation—or mail coupon for complete information.

Balsam-Wool

SEALED ATTIC INSULATION

Balsam-Wool... Products of Weyerhaeuser... Nu-Wood

WOOD CONVERSION COMPANY

Dept. 210-6, First National Bank Bldg.
St. Paul 1, Minnesota

Gentlemen: I want to know more about Balsam-Wool Double-Value Attic Insulation.

To assist us in giving you special information, please check: I am a home owner ☐

renter ☐ architect ☐ contractor ☐

student ☐

Name.....

Address.....

City.....State.....



out the night the convoy played hide and seek with Jap bombers and submarines. At dawn five planes roared out of the east.

"We saw the bombers coming in," related one of the truck drivers. "One of them dropped a bomb 400 yards off the starboard bow. The ship's guns opened up and we let loose with the machine guns mounted on our trucks. The combined fire of the ship's anti-aircraft and the machine guns on the trucks caught one of the Jap planes. It burst into fire and plunged into the sea. The others fled. Our skipper said we rated a share in bringing down the Jap bomber. He told us to paint small Rising Suns on our trucks—just like the pilots do. Boy, that was a thrill!"

Seabees are masters of improvising. They have made the unglamorous oil drum serve a dozen uses of which its manufacturers never dreamed—culverts along swamp roads, lining for drainage ditches, stoves and ovens, trusses to reinforce building construction, baffles for buildings, buoyants for rafts and even for a small floating drydock, basins, tubs, roofing (after being flattened), piping and riprapping. A couple of Seabees welded together six drums to make a sightseeing canoe, complete with Japanese seaplane floats for outriggers.

Seabees on Guadalcanal, who built the "Guadalcanal, Bougainville and Tokyo Railroad," think they set a world's record in railroad construction. It took them just three days to lay track a mile and a quarter long, and another two days to build a pier at its terminus.

Perhaps the greatest satisfaction of the Pacific war to date was gained by a husky Seabee driver and his bulldozer. The huge machine rumbled ashore in the face of Japanese fire. Spotting a Japanese machine gun a few hundred yards from the beach, the Seabee driver headed for it.

The tough steel scraping blade of the bulldozer served as a shield. As the Seabee driver neared the machine gun nest, he lowered the blade and scraped Japs, machine gun and all into their graves.

He grinned and said "So sorry, please!"

Shepherds of the Convoys

Continued from page 37

resulted in the capture of Nazi crewmen. Four Avenger and two Wildcat pilots harried the sub with continuous bombing and strafing until one load of depth charges landed squarely and the vessel blew up so violently that only 17 of its crew survived.

In another action two U-boats were sighted, fully surfaced and on parallel

Continued to page 154

Here's how your car *FEELS*...



...after

MARFAK

chassis

lubrication!

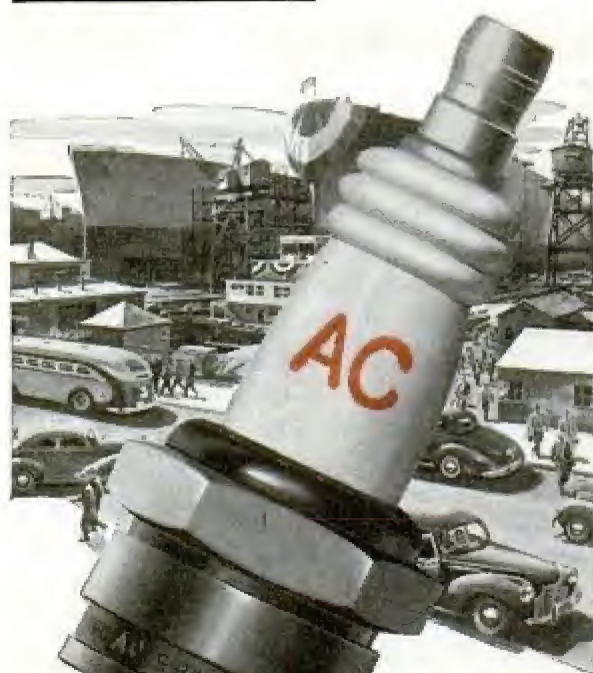
Car drive like a tank? Time for MARFAK chassis lubrication — Texaco's tough, long-wearing lubricant that silences, softens and soothes the crankiest chassis. MARFAK is applied by chart, never by chance. Every lubrication point is indicated — from control arms to rear shackles. Your car gets a careful check-up, too — every point of wear, every point of adjustment. Ask your Texaco Dealer to give your car that "MARFAK feeling" — tomorrow!

Let us
MARFAK
your car



TUNE IN: FRED ALLEN every Sunday night. See your local newspaper for time and station.

Thousands of the men and women who build ships for Victory keep their spark plugs "on the job" longer with regular cleaning and adjustment. When replacement is necessary, they specify AC Spark Plugs for utmost reliability.



CLEAN SPARK PLUGS SAVE UP TO ONE GALLON OF GAS IN TEN

AC
SPARK PLUGS

BUY WAR BONDS AND BRING VICTORY QUICKER

courses, only 50 yards apart. An Avenger raced to the attack and one sub dived. The other sped toward a nearby fog bank, the while hurling flak at the attacking plane. Diving through the blistering fire, the Avenger straddled the sub with its bombs and it sank. Again, the U-boat's commanding officer, with 12 others, was captured.

Duels between the prowlers of the deep and the Navy's knights of the skies are not entirely one-sided. U-boats fight back, with heavy and often accurate antiaircraft fire. Even the routine of takeoff and landing in the North Atlantic is hazardous. Hitting the bobbing flight deck in a gale calls for all the skill the men in the planes and aboard the ship can command.

Yet in foul weather flying is especially important, for then the U-boat skippers are most apt to think the high wind and heavy seas will keep the planes down.

The veteran carriers with which we started this war have been supplanted also by those of the Essex class coming into action; those converted from a class of 10,000-ton cruisers, and the fabulous, 45,000-ton CVB's under construction. Oddly, the baby flattops have even had their influence on the construction of the heavily armored, highly compartmented 45,000-tonners. For the CVB's, in the words of Rear Admiral E. L. Cochrane of the Bureau of Ships, incorporate some refinements in gun distribution and safety measures based on the experiences of the escort carriers.

Born of necessity, masterpieces of almost desperate improvisation, the baby flattops have proved their right to inclusion in any Navy list of combatant ships.

Switchyards for Nation's Power

Continued from page 75

insulators. The dust was inert as long as the atmosphere remained dry but in high humidity it became a conductor, allowing the current to short across the insulators. Now the insulators are washed regularly.

New problems are always coming up. The caddis fly, for instance, favored by fishermen as a lure for trout, is a headache to hydro-electric engineers in some areas. The little insect has been known to reduce the output of a power plant as much as 10 percent. The larvae of the fly, floating downstream, attach themselves to the walls of intake tunnels that lead to the power turbines. They spin webs that catch particles of dirt, reducing the tunnel's diameter and cutting down the amount of water that reaches the turbines. Intake tunnels must be cleaned of the growths each spring.

Continued to page 156



When tooth paste tubes develop cracks
Or shaving-cream tube breaks
A patch of Texcel Tape stops waste—
A moment's all it takes !

Where kiddies eat, the painted walls
And woodwork stay quite clean.
A paper shield with Texcel Tape
Provides a makeshift screen.



It's Texcel Tape for packages
And scores of other things,
For quick and handy mending and
In place of glue and strings.

For Texcel is an improved tape
Whose "stick-um's" bonded on.
It won't come off, it won't dry out
Before the judgment dawn.

Since all the Texcel Tape that's made
Is being used for war,
Buy Bonds and Stamps 'til Victory
Returns it to your store.



Texcel Tape

CELLOPHANE TAPE — STICKS WITH A TOUCH

Made by
Industrial Tape Corporation
A Division of
Johnson & **J**ohnson
New Brunswick, N.J.

Some things haven't changed!

LHS
STERNCREST

STERLING

Every pipe produced from genuine imported Mediterranean briar of pre-war quality, and shaped by the skilled hands of master craftsmen to be "A thing of beauty and a (smoking) joy forever". Sterling Silver band; solid rubber bit. Every pipe numbered, and registered by LHS, as your guarantee of pipe perfection.

\$5

Smooth and
Antique
Finish.

Many hand-
some models.



"Perfection ... in a Pipe"

LHS STERNCREST 14K

The custom craftsmen of LHS select the very choicest grains for these patrician pipes. They finish them by an exclusive process that brings out the full beauty of the briar,—circle them with a band of solid gold. **\$7.50**
Truly, "Perfection—in a Pipe"

L & H STERN, Inc., Stern Bldg., Brooklyn, N.Y.

Makers of the famous

LHS Ultra-fine \$10 Certified Puxex \$3.50 Superfine Puxex \$1.50

Put this in your
pipe and smoke it:



BUY WAR BONDS

To reduce energy losses, engineers put a motor-generator set that is used for changing current from one frequency to another inside an airtight steel shell, then fill this shell with pure hydrogen. Hydrogen is a better conductor of heat than is air, so the machine operates at a cooler, more efficient temperature. Hydrogen is lighter than air, also, and the energy used by the machine's rotating parts in overcoming air resistance is reduced. As much as 500 kilowatts of power that otherwise would be lost is saved when a big frequency changer is operated in a hydrogen atmosphere.

Early in the war it was feared electricity would have to be rationed, so great were the industrial demands. By adding to its generating capacity, by interconnection, and by increasing its efficiency, the American power industry has kept ahead of the greatest demand it ever faced.

Growing a New World

Continued from page 31

its chemurgic niche. Tannin, for the leather tanning industry, has been found in profitable amounts in this bark.

Nowhere is the story of chemurgy more brilliantly told than in the new uses for cotton and the soybean. In scarcely a decade the versatile oriental bean has become a major American crop with a harvest of over 200,000,000 bushels yearly. It is valuable for its oil for lubricating, for paints and plastics; for its protein, an animal and human food; and for textile fibers.

New uses are constantly being found for cotton. The jute for sandbags that came from India is now replaced by cotton.

Smokeless powder has traditionally been made from the linters—the fuzzy hairs that adhere to the cotton seed when the fibers are removed. The chemurgists have devised machines to cut the cotton itself into short lengths like linters, and have made available enough short staple cotton to meet any requirements for powder.

No nation can look toward the future with equanimity when its prosperity depends upon mineral raw materials alone, for they are always expended far faster than they are replaced. Geologists have voiced warnings at the rate of exhaustion of our petroleum, iron and other minerals.

But any product of a vegetable source can, in theory, be grown at the same rate it is used—and therefore never be exhausted. The more we can rely on plastics from vegetable sources, the less we need rely on exhaustible metals; the more we use vegetable fuels or lubricants, the less critical becomes our pool of petroleum.



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Cameras*

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MILLERS FALLS TOOLS

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TOOL MAKER for the TOOL-MINDED

It's an American trait that is helping to win the war . . . this being tool-minded. Even though we may not make our living at it, most Americans know how to handle tools . . . and demand good tools.

Tops in tool making for a tool-minded nation is Millers Falls. That familiar trademark is a guarantee of dependability, durability and precision.

Millers Falls-quality line includes planes, hack saws, braces, auger bits, precision instruments, electric drills, hammers, nut runners, sanders, screw drivers and grinders — everything for discriminating craftsmen.

FOR EXAMPLE: PLANES

Ten sizes — lengths from 7" to 24" — comprise the standard Millers Falls line of bench planes. Each serves a separate purpose: short models for finishing broad, flat surfaces, reaching into the low spots; jack, fore and jointer models are progressively longer, for increasing degrees of straight, smooth cutting. Three exclusive features; three-point bearing lever cap, solid tool steel cutter, perfect fitting cutter cap.



MILLERS FALLS
COMPANY

Greenfield, Mass.
U. S. A.

Lifeline of the Fleet

Continued from page 69

plies at advance depots, at rendezvous points, or—if time permits—at a permanent base removed from the danger zone. Also, in the overseas supply system are submarine supply centers, Diesel spare parts centers, and other special pools. BuSanda, as our Bureau is known in the Navy, has organized "material recovery units" to salvage equipment and spars parts in combat areas. In theaters of joint Army-Navy operations there is close cooperation, with free interchange of supplies without exchange of funds.

In 1940 there were only two naval supply depots—one on the east coast and one on the west. Since 1940 storage space at Navy Yards and stations has been enlarged, with the two original supply depots expanded and additional coastal depots established, as well as four inland depots at Clearfield, Utah, Mechanicsburg, Pa., Spokane, Wash., and Scotia, N. Y.

With maximum decentralization, BuSanda exercises control over standard stocks by central procurement. "Procurement group forms" on which are entered the stock number and description of each item the bureau will buy are sent to each major depot. Minor depots (authorized to keep a maximum of six months' stock) report needs to the major stations, which combine them with their own estimated needs for ships and overseas points and forward them to the bureau. Thus, at fixed intervals the bureau is informed of needs and excesses on each item.

The launching of a great battleship, such as the Iowa or Missouri, presents a tremendous supply problem, not unlike stocking a newly-built city. When a battleship slips down the ways, the thousands of items to fill its vast hold—down to the last bag of coffee or carton of cigarettes—are piled in a big warehouse, exactly tagged to indicate the space they will occupy aboard ship.

One arm of the bureau is the transportation division, charged with routing and distributing Navy shipments, and arranging priorities on shipments by Naval Air Transport Service and other cargo planes.

The Naval Air Transport Service is performing a magnificent job. Recently a submarine in the South Pacific was in need of a part which could not be secured overseas. The manufacturer furnished the gear in 24 hours, and just four days later a Navy cargo plane delivered the part to the submarine 10,000 miles away.

Another case was of a cruiser in a for-

Continued to page 160

SCREWBALL IDEAS ON BATTERY CARE

#3

This one's a killer, if you're one of those who believe in black magic and voodoo. It's the old electrolyte gag, the enchanted liquid which puts batteries on the blink fast. Some folks have an idea that a battery can be recharged without essential equipment and skill, but don't believe it ... it can't be done.



... THE WISE WAY IS PERIODIC RECHARGES !

RESTRICTED driving damages batteries, because they just can't get a normal recharge from the generator when mileage is rationed. That calls for certain precaution in many cases ... and Exide has the answer.

An experienced Exide Dealer will give your battery a check-up, and when necessary, advise a *periodic recharge*. Periodic recharges put off the day when you'll need a new battery, and that's important today. When you *must* buy, get a dependable, long-lasting Exide. Buy to Last — Save to Win.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

EXIDES ARE USED IN MORE THAN 100
APPLICATIONS BY OUR ARMED FORCES



- 1 Don't buy *anything* you can do without.
 - 2 When you **MUST** buy, insist on dependable, long-lasting merchandise.
 - 3 Take care of the things you have. *Make them last.*
- These conservation rules save materials for war production, help curb inflation, give you more money to invest in War Bonds.



WHERE DEPENDABILITY REALLY MEANS SOMETHING

Dependable
CHAMPION SPARK PLUGS
ARE ON ACTIVE DUTY!

Maximum performance and dependability are the two qualities that are absolutely essential in spark plugs for our armed forces. Champion Spark Plugs have certain exclusive and patented features which insure these qualities and are being used by our armed forces, on land, water and in the air. The traditional dependability of Champions under the most adverse operating conditions is thus being emphasized as never before. You, too, can depend on Champions for better performance in every engine.



LET'S ALL BACK THE ATTACK—BUY WAR BONDS

eign port, laid up by a defective gear. The nearest replacement was in the Navy Yard at Philadelphia—5,300 miles away. The NATS loaded the three-ton part on an R4D (Navy designation for the Douglas DC3) and delivered it to the stricken cruiser in 34 hours and 31 minutes.

The air cargo service was formed five days after Pearl Harbor with a nucleus of seven planes. Today, the Navy's airline has more than 200 planes, employs 8,000 men, and flies 3,600,000 miles a month on scheduled trips to Europe, Africa, South America, Australia, the South Pacific, and the Aleutians. Early this year it was transporting 22,500 priority passengers and 8,300,000 pounds of cargo a month.

Typical shipments include periscope parts for submarines, parts for PT boats and aircraft carriers, airplane engines, generator parts, antiaircraft guns, blood plasma, drugs and other critical supplies. The NATS' most famous cargo ship is the giant flying boat Mars which on one trip carried a record air load of 35,000 pounds.


Secretary of the Navy Knox has said: "This is a war of supply." The Navy's supply system is pointed solely toward keeping all combat vessels in fighting shape. We have seen what over-extended supply lines have meant to the Japanese Navy in the Pacific and profited from that lesson.

Aviation in Long Pants

Continued from page 25

United Air Lines has applied for 6,350 more miles in this country. TWA would add a 2,557 mile run from Los Angeles to Honolulu and 4,527 miles transatlantic to London, Paris, and Cairo, plus 4,500 more American miles, for a total route mileage of 20,000. The company not long ago acquired control of TACA, Latin American line. American Export Lines proposes dawn-to-dusk service to Europe: a north-

Continued to page 162



Model Builders Attention!

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug
 Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Silliment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

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Today, tomorrow and until the war is won every Allison engine is built to a standard that embraces five "must" qualities: ★

Performance that helps our fighters win battles. ★

Reliability on which our pilots can depend. ★ *Smoothness*

to lessen pilot fatigue. ★ *Economy*

for greatest fighting range. ★

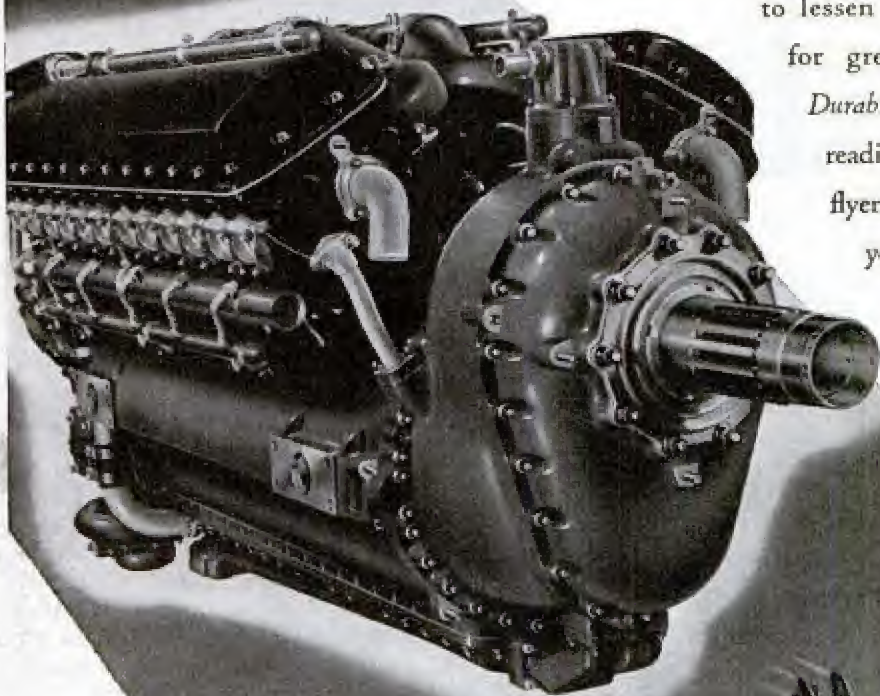
Durability for maximum fighting

readiness. ★ Vital now for our

flyers, these are also characteristics

you will want in engines that

will power postwar planes.



POWERED BY ALLISON:

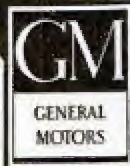
The more-than-50,000 Allison engines built for the U. S. Army Air Forces power the following planes:
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P-40—Warhawk • A-36 and P-51—Mustang

LIQUID-COOLED AIRCRAFT ENGINES

Allison

DIVISION OF

Indianapolis, Indiana



**KEEP AMERICA STRONG
BUY MORE WAR BONDS**

RED-ITCHY SKIN?

watch out—it's often

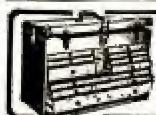
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ern route to Britain, Paris, Rome, Athens, Cairo, Basra and Karachi, branching from Athens to Istanbul, Bucharest and Sevastopol. A southern line would serve Cape-town, S. Africa, via Puerto Rico, Trinidad, Belem and Natal, Ascension Island and Windhoek, branching from Natal to Dakar, Casablanca, Algiers and Rome. Pan American Airways, veteran of international Clipper routes, would touch 46 countries on a 50,000 mile schedule. Braniff covets lines to Europe, South America and the Caribbean, adding 19,719 new miles. Eastern Air Lines would link Montreal, the Atlantic seaboard, midwestern cities and South America. Northeast Air Lines applies for 22,000 miles of routes to England and northern Europe. Many others, among them Greyhound, Burlington Transportation Co., Pennsylvania Railroad, Missouri Pacific and Texas Pacific, United Fruit company steamship line, Trans-Canada Air Lines and Canadian Pacific Air Lines, and the All-American Aviation Company—the latter already doing a pickup service from Kentucky to New York—ask to be included in the postwar air transport picture. Note that, gossip of trans-polar routes to the contrary, no one wants to fly across the top of the world. Instead, great circle routes between ports of dense traffic will apply. Actual flight over the Pole would be uneconomical, requiring costly bases on the ice cap, where fuel and supplies could be delivered only by air.

To take care of the anticipated congestion in the air a decade hence, the CAA is planning safety rules, equipment, airport traffic controls—and airports. In the last three years we have increased the number of airports capable of handling big transport planes from 94 to 940. Airports of all types total 3,000. Soon we shall need 6,000. The biggest remaining market appears to be short-haul traffic reaching smaller cities; only 52 of the 122 cities of 25,000 to 50,000 population have direct air service, only 58 of the 143 cities of 10,000 to 25,000.

Tremendous plans are on the way. The concrete had scarcely set on LaGuardia Field before New York began its Idlewild airport, six times bigger, on the shore of Jamaica Bay at Queens, to be ready about three years after the war. Oklahoma City contemplates a \$25,000,000 midcontinent port with 11,000-foot runways built to land 150-ton planes. Hartford, Conn., hopes to become a takeoff point for transatlantic air ferries. San Francisco and Oakland plan a \$60,000,000 airport.

Although there is a common belief that runways must lengthen as aircraft engine

Continued to page 164

POPULAR MECHANICS



Guarantee

Add Casite to crankcase and run through carburetor according to instructions, then drive your car 100 miles or for 60 days, whichever is first. If not convinced that Casite gives you better and smoother performance, you get double your money back by filling out guarantee certificate and mailing it to The Casite Corporation, Hastings, Michigan. Maximum refund is \$1.30 per pint, twice the nationally advertised price of Casite.

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● You can't get by with today's gasoline if your motor is dirty, gummy, and full of sludge. Clean it out, and keep it clean, with CASITE.

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power increases, runways equivalent to one mile long at sea level meet CAA requirements, which are based on the possibility of one engine failing after takeoff. Airport capacity is based on the number of planes which can land and take off on instruments in thick weather, and the CAA recommends parallel runways for landing and takeoff, with additional airports six to ten miles away whenever plane movements exceed 30 per hour during rush hours. The need in general is not for bigger airports, but more of them. Which may give the helicopter its biggest opportunity in taxiing through passengers from Airport No. 1 to Airport No. 2 or 3 to hop the feeder line down to Emporia.

The air lines stand where the automobile stood in 1918, where the railways stood in 1865. Private flying is just outgrowing its rompers. There is no place in the world more than 60 hours by air from your home.

The Voice of America Speaks

Continued from page 5

ground of actual bomb bursts and gunfire. Wading through the jungle to the command post, he said to a Marine there: "I understand I can get 110-volt 60-cycle current here. Do you have it?"

"No," said the Marine, "but if you go up the trail another 40 yards and ask the guys up there, they might give it to you."

"That's fine," said Maypole. "Who's up there?"

"Japs."

A bomb caved in his recorder a few days later, but he had his record intact on magnetized wire.

Radio reporters have been bombed out of bed in London and fallen out of the sky into the Burmese jungle. Charles Collingwood of CBS entered Tunis with the first Allied troops and raced all night to Algiers to reach a transmitter in time for the morning "News of the World." Merrill Mueller of NBC, after being hospitalized by a bomb in the Battle of Britain and escaping the Japs at Sumatra and Java, landed with the first wave of Yankees in Sicily and ducked under water with his typewriter held over his head while Nazi planes strafed the troops.

The Voice of America is many voices on every continent and a multitude of islands. When the Voice finally brings home the good news of the enemy's surrender, it will have played an influential part in victory by supporting the morale of our fighting men, breaking the morale of our enemies, bringing the truth home to us and carrying the truth to friend and enemy overseas.

Thank You, America, for your Tremendous Endorsement of Zenith's Crusade to Lower the Cost of Hearing!

Zenith Radio Corporation
CHICAGO

OFFICE OF
E. F. McDONALD, JR.
PRESIDENT

To: The Hard of Hearing, and
All Who Are Interested in Them.

Last November Zenith said: From now on, NO ONE NEED PAY MORE THAN \$40 FOR A QUALITY HEARING AID. Your phenomenal purchases testify how completely you agree. Already, your demand has made Zenith's rate of hearing aid production THE LARGEST IN THE WORLD TODAY!

By placing Zenith's finest quality within reach of all, the new Zenith Radionic Hearing Aid is restoring thousands in every walk of life to the world of sound. It is rehabilitating men and women for greater usefulness in wartime work. It is removing the shadow of failure from school children whose lives were darkened by defective hearing.

Some have asked "How can Zenith's finest precision quality sell at this revolutionary low price?" That Zenith is the world's leading maker of radionic products exclusively is but a partial answer.

Perhaps more basic is this: Zenith builds not to a price, but to an improved modern principle of hearing aid design: The principle of instant personal adjustment. You, yourself, "focus" this instrument for your particular hearing needs — for different voices and soundings — as conveniently as you focus a pair of binoculars!

Thus with the Zenith there is no need for old-way testing and frequent adjustments by high-pressure salesmen. There is no need for home calls and other expensive sales promotion. The quality is in the instrument itself, where it belongs!

By its excellence, by its low price and low-cost battery upkeep, the Zenith is bringing about something new in our nation. It is making the hearing aid as popular among those with impaired hearing as eyeglasses are among people with impaired vision.

For your understanding of Zenith's Crusade to lower the cost of hearing for your overwhelming response to the new Zenith Radionic Hearing Aid, THANK YOU AMERICA!

E. F. McDonald, Jr.

President, Zenith Radio Corporation

P.S. To those not yet wearing a Zenith: You are invited to attend a demonstration at your local Zenith-franchised optical establishment. HEAR THE PROOF.

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\$40 Ready
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Complete with Radionic Tubes, Crystal Microphone, Magnetic Earphone, Batteries and Battery-Saver Circuit. One model—no "decoys" . . . One price—\$40 . . . One quality—Zenith's best. Covered by a liberal guarantee.

Accepted by American Medical Association Council on Physical Therapy



There are cases in which deficient hearing is caused by a progressive disease and any hearing aid may do harm by giving a false sense of security. Therefore, we recommend that you consult your otologist or ear doctor to make sure that your hearing deficiency is the type that can be benefited by the use of a hearing aid.

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UNIVERSAL BOAT AND LUGGAGE TRAILERS

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FILLS NAIL HOLES!

PLASTIC WOOD fills old nail and screw holes fast, for secure hanging of doors, curtain rods, window shades. Handles like putty; hardens into wood.



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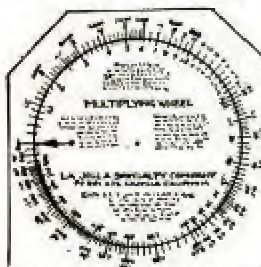
"HAVE A PATCH READY"

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For Multiplying, Dividing, Finding Areas, Circumferences and everyday figuring. No instruction book needed.

All information on wheel.

Just turn the wheel for the answer.

If you cannot operate it in five minutes, send back in ten days and we will refund your money.

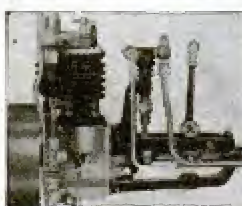
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2 Crew Carries Boat — and motor! So light are the Army's Storm Boats that their crews can readily carry them and their powerful motors. Underway, they "plane" like-racers, can be "crash-landed" on beaches completely clear of the water.



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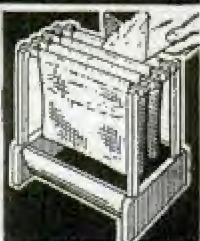


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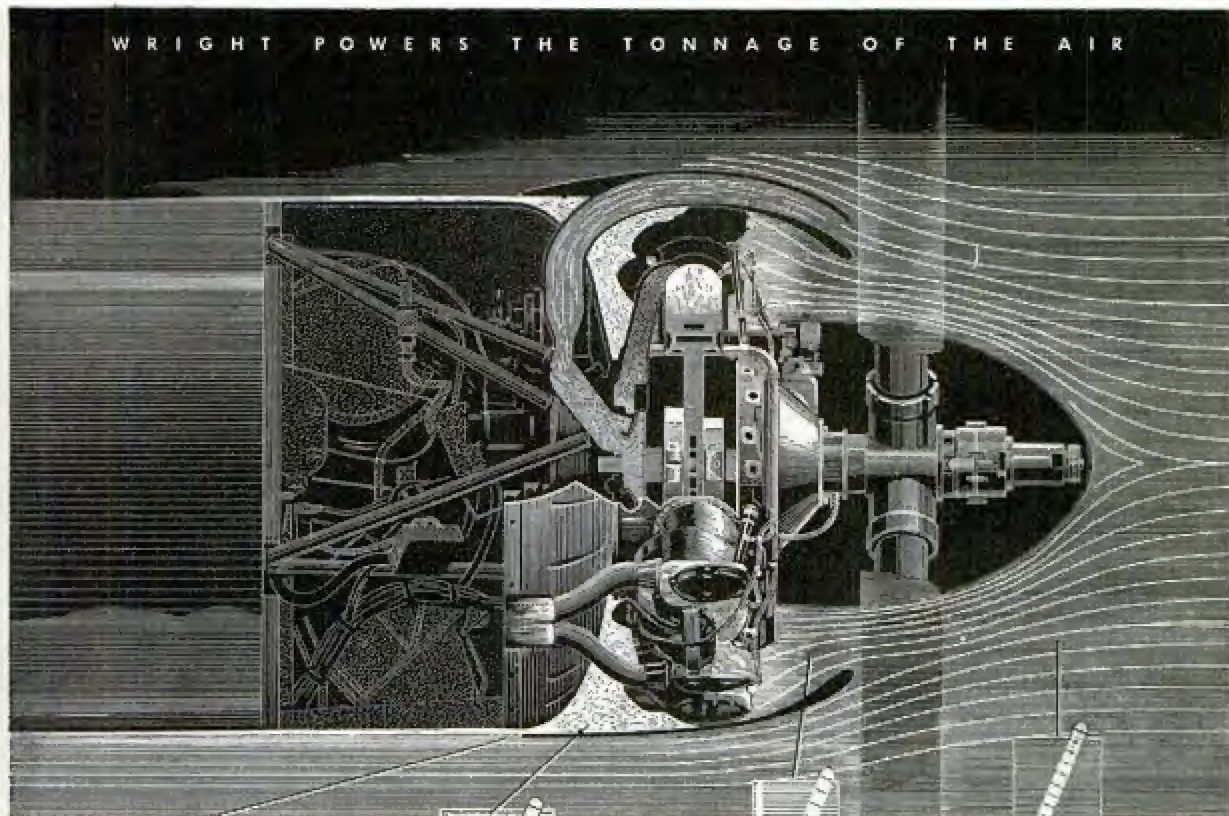
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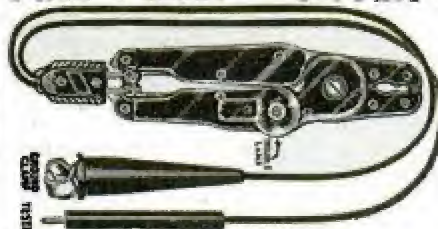
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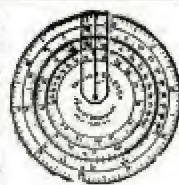
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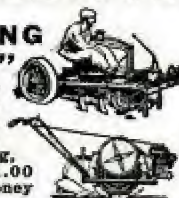
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This little General Electric Uviarc will kill the disease-producing germs in this jar of infected water in less than a minute. An 8-watt Uviarc will disinfect water at the rate of 100 gallons per hour. Such irradiation leaves no taste.



One 30-watt General Electric Uviarc will kill 90% of the disease-producing germs in 700 cubic feet of air in one minute. It will effectively disinfect air in a room 10x10x20 ft. every ten minutes. In larger rooms, such as this experimental schoolroom, more than one Uviarc is used.

BUY MORE WAR BONDS

General Electric makes the Uviarc but does not make fixtures for its use. For an illustrated folder giving further information write General Electric Co., Division 166-PM-6, Nela Park, Cleveland 12, Ohio.



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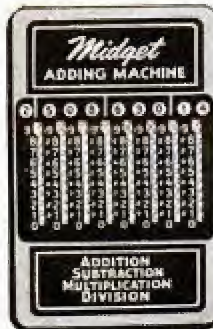
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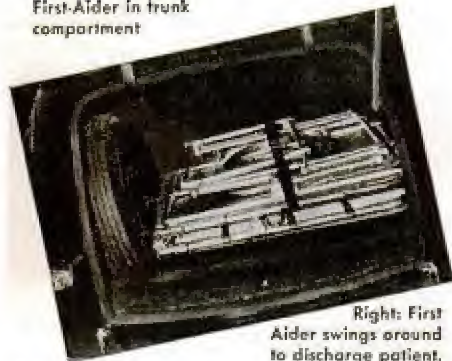
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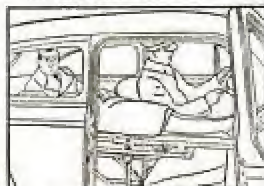
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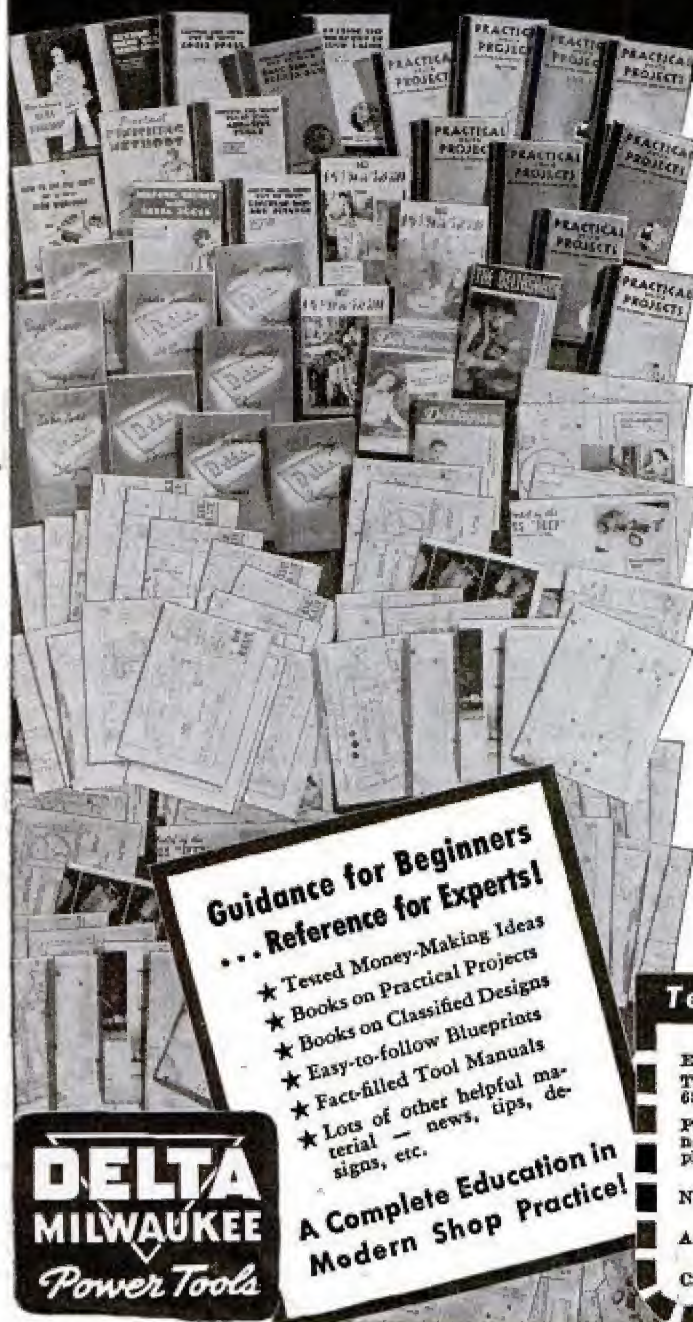
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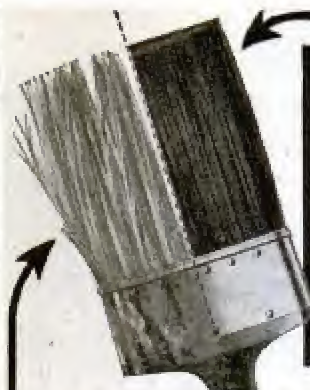
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JUNE, 1944

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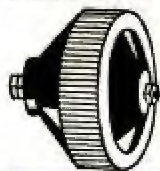
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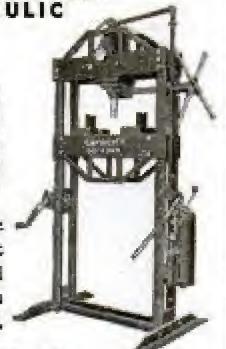
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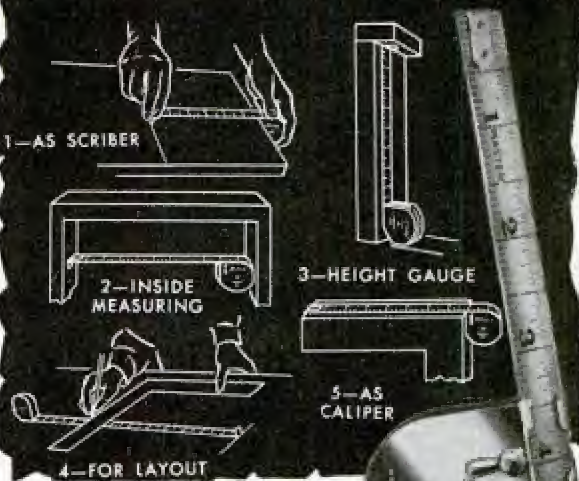
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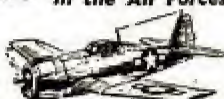
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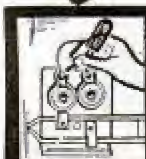
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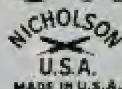
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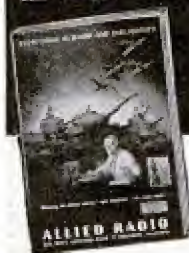
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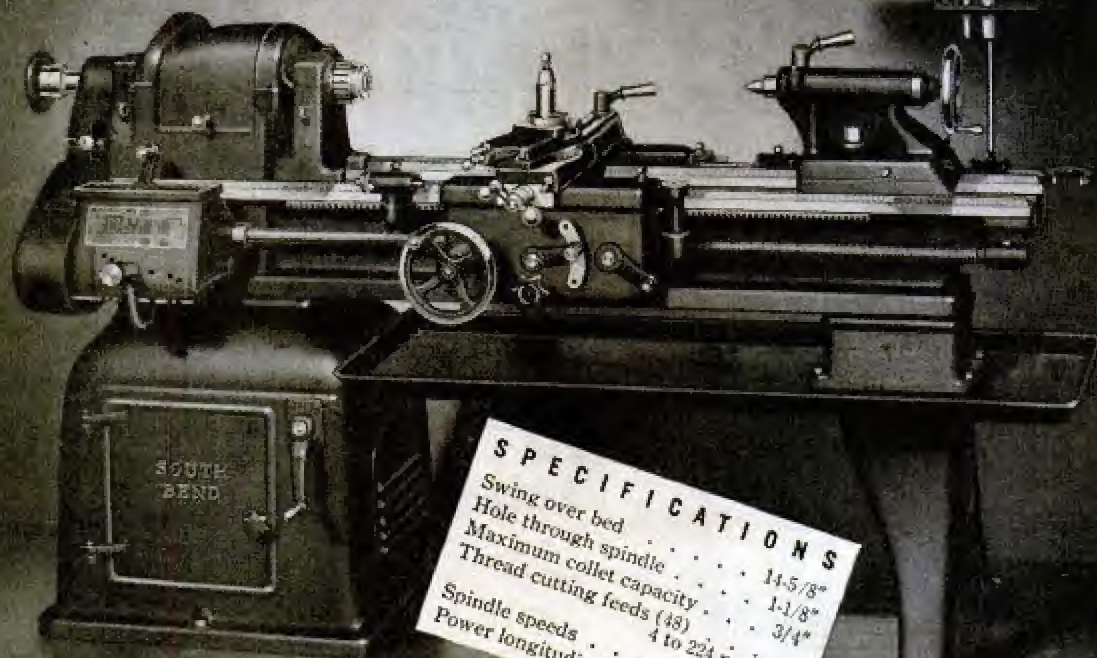
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